DETAILED PROJECT REPORT AND INTEGRATED ENVIRONMENTAL ASSESSMENT LITTLE FOSSIL CREEK HALTOM CITY, TEXAS

INTRODUCTION

STUDY AUTHORITY

This Detailed Project Report (DPR) is submitted under the authority of Section 205 of the Flood Control Act of 1948, as amended. The feasibility study was conducted in response to the letter of request, dated May 25, 1994, from Haltom City. Section 205 of the Flood Control Act approved 30 June 1948, as amended, states:

"The Secretary of the Army is authorized to allot from any appropriations heretofore by Congress, which come within the provisions of Section 1 of the Flood Control Act of 22 June 1936, when in the opinion of the Chief of Engineers such work is advisable. The amount allotted for a project shall be allotted under this section for a project at any single locality. The provisions of local cooperation specified in Section 3 of the Flood Control Act of 22 June 1936, as amended, shall apply. The work shall be completed in itself and not commit the United Sates except as may result from the normal procedure applying to projects authorized after submission of preliminary examination and survey reports."

STUDY PURPOSE AND SCOPE

The objective of the feasibility level investigations was to examine the water and related land resources problems and opportunities along Little Fossil Creek within the city limits of Haltom City, Texas. The most significant problems analyzed by the investigations were frequent flooding, the consequent damages, and the effect on those who reside within the floodplain. Data on historic flooding and damages were investigated and included in this study. Projections of future development and its anticipated effects on the problem were also made.

During the feasibility study, a range of structural and nonstructural measures was examined. Some measures were discarded from further consideration early in this study when it became apparent that they were not engineeringly sound or economically feasible. The alternative measures, which showed potential, were developed to determine their feasibility based on engineering considerations, economic justification, needs of the area, environmental considerations, and the social well being of the local and adjacent residents. Comparative analysis of each alternative's benefits and costs narrowed the number of alternative plans. Additional data and more detailed analyses resulted in refinement of the alternatives and the identification of an alternative as the Recommended Plan, i.e., the alternative recommended for implementation.

STUDY PARTICIPANTS AND COORDINATION

The Fort Worth District, Corps of Engineers, acting at the request, and in coordination with Haltom City, completed this feasibility study. The Project Delivery team was comprised of various engineers, scientists, and other professionals from the Fort Worth District, as well as representatives from Haltom City. In addition, coordination was maintained with other government officials, the news media, citizens, and various Federal, State and local agencies throughout the study. Coordination with the City of Fort Worth and the Texas Department of Transportation (TxDOT) was closely maintained, due to potential impacts to infrastructure held by the respective agencies. Direct coordination was also maintained with the U.S. Fish and Wildlife

Service in accordance with the Fish and Wildlife Coordination Act of 1958 (16 USC 661-666C: 48 STAT. 401), as amended. Other agencies of particular note were the United States Environmental Protection Agency, Texas Parks and Wildlife Department, Texas Natural Resource Conservation Committee, and the State Historical Preservation Office.

PRIOR STUDIES AND REPORTS

The following are studies and reports that have been conducted concerning or related to Little Fossil Creek in Haltom City, Texas.

Little Fossil Creek, Haltom City – Floodplain Information Report 'Big and Little Fossil Creeks'. The Fort Worth District prepared this report in May 1974. Its purpose was to furnish information on the flood hazard areas along those two streams and Whites Branch (a tributary of Big Fossil Creek, upstream of Haltom City).

Engineering Report on Channel Improvements for Little Fossil Creek, Haltom City, Texas. The report was prepared in May 1975 by Rady and Associates, Inc., a local engineering firm. It provided a conceptual design for a channel that would contain the 100-year flood flows based on 1975 conditions.

Little Fossil Creek, Haltom City - Flood Insurance Study 1975. The Fort Worth District completed a flood insurance study for the Federal Insurance Administration of the Department of Housing and Urban Development.

Little Fossil Creek - Flood Insurance Study 1984. The Fort Worth District updated the FIS of 1975 for the Federal Emergency Management Agency (FEMA). However, the previous FIS in the specific reach of Little Fossil Creek within Haltom City was not revised.

Little Fossil Creek, Haltom City - Reconnaissance Report, December 1987. This Congressionally authorized study, examined water and related land resources within the Little Fossil Creek watershed. Flooding along the main stem of the creek between Broadway Avenue to the southern city limit was identified as the most significant problem. It was determined that a channel modification was economically and technically feasible. The channel modification would be approximately 10,000 feet, trapezoidal, and grass-lined with bottom widths ranging between 70 and 100-feet. Total project cost was estimated at $10.3 Million and annual project costs were estimated at $962,900. Expected annual benefits were estimated at $2.0 million. This alternative for flood damage reduction had a benefit-cost ratio of 2.1. While the study concluded that further investigations were warranted, Haltom City elected not to participate in a cost-shared feasibility study at that time.

Little Fossil Creek, Haltom City – Flood Insurance Study 1987. The Fort Worth District conducted an updated FIS for the Federal Emergency Management (FEMA). The analysis for this particular study was retained for use in the current Section 205 Feasibility Study, with the only modification relating to the expansion of the reported outputs to include a wide range of flood event frequencies, rather than the four standard flood events reported in the FIS.

PROBLEM IDENTIFICATION

LITTLE FOSSIL CREEK WATERSHED AND STUDY AREA

Haltom City is located in Tarrant County, generally northeast of downtown Fort Worth. The study area is the lower portion of the watershed, which includes the area from the confluence with Big Fossil Creek upstream to Beach Street – a stream length of approximately 23,000 feet. Figure 1 is a map of the project area, which includes the Haltom City portion of Little Fossil Creek.

Little Fossil Creek and its tributaries are located entirely within north central Tarrant County. The stream originates near Saginaw and flows southeasterly through Blue Mound, Fort Worth, and Haltom City where it confluences with Big Fossil Creek near the West Fork of the Trinity River. The channel in the lower portion of the creek, downstream from Beach Street, shows signs of having prior channelization. Approximately half of Little Fossil Creek upstream of Beach Street has been channelized by non-federal entities. The entire watershed averages 1.7 miles in width and 11 miles in length with a drainage area of 18.26 square miles. Figure 2 is a map of the watershed.

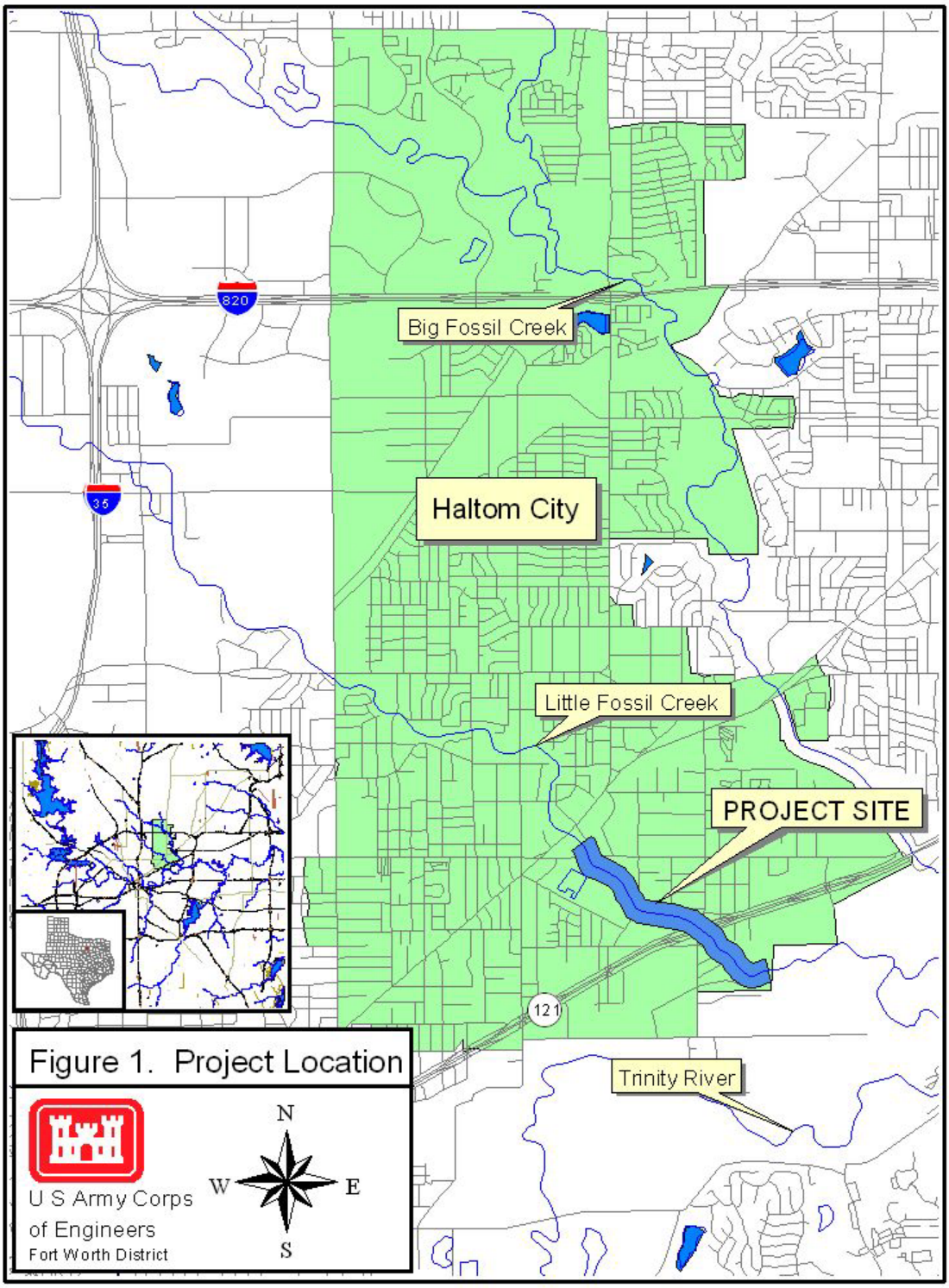
AREA CLIMATE

The study area generally experiences warm climate conditions with hot summers. Temperatures in this area have ranged from 113 °F in June 1980 to a minimum –1 °F in December 1989, with an average annual temperature of 65.6 °F. The region is prone to intense local thunderstorms and consequent flash flooding that can and does frequently occur. The average annual precipitation is approximately 32 inches, which includes an insignificant amount of snowfall. The relative humidity averages approximately 66 percent.

GEOLOGY AND PHYSIOGRAPHY

The Little Fossil Creek study area is located within the Grand Prairie subdivision of the West Gulf Coastal Plain section of the Coastal Plain physiographic province. The Grand Prairie encompasses a north-south trending area of approximately 20,000 square miles. The topography of the Grand Prairie is characterized by rolling hills with angular valley slopes that exhibit scarps and terraces. Vegetative growth is generally limited to grasses and sparse trees, with more densely vegetated areas located primarily within floodplains. Geologic units within the Grand Prairie subdivision are Cretaceous Age and younger, and represent a regressive sequence, the transition from a marine to terrestrial environment, trending southeastward toward the present Gulf of Mexico.

Geologic units present within the Little Fossil Creek study area include Quaternary floodplain and terrace deposits near the surface, consisting of clays, sands, and gravels. Little Fossil Creek has cut into these deposits at depths ranging from 10 to 20 feet within the study area, creating bank slopes that are steeper than 1:1 (Vertical: Horizontal) in many places. A layer of recent, coarse deposits, primarily gravels and cobbles, currently covers the channel bottom within Little Fossil Creek. Beds of fossiliferous limestone and calcareous shale of the Cretaceous Age Pawpaw formation, a subdivision of the Washita group, underlie these fluviatile deposits at a depth of approximately 20 feet below ground surface. The Pawpaw formation is undifferentiated in the study area.


820
35
Big Fossil Creek
Haltom City
Little Fossil Creek
PROJECT SITE
121
Trinity River
Figure 1. Project Location
U S Army Corps
of Engineers
Fort Worth District
N
W
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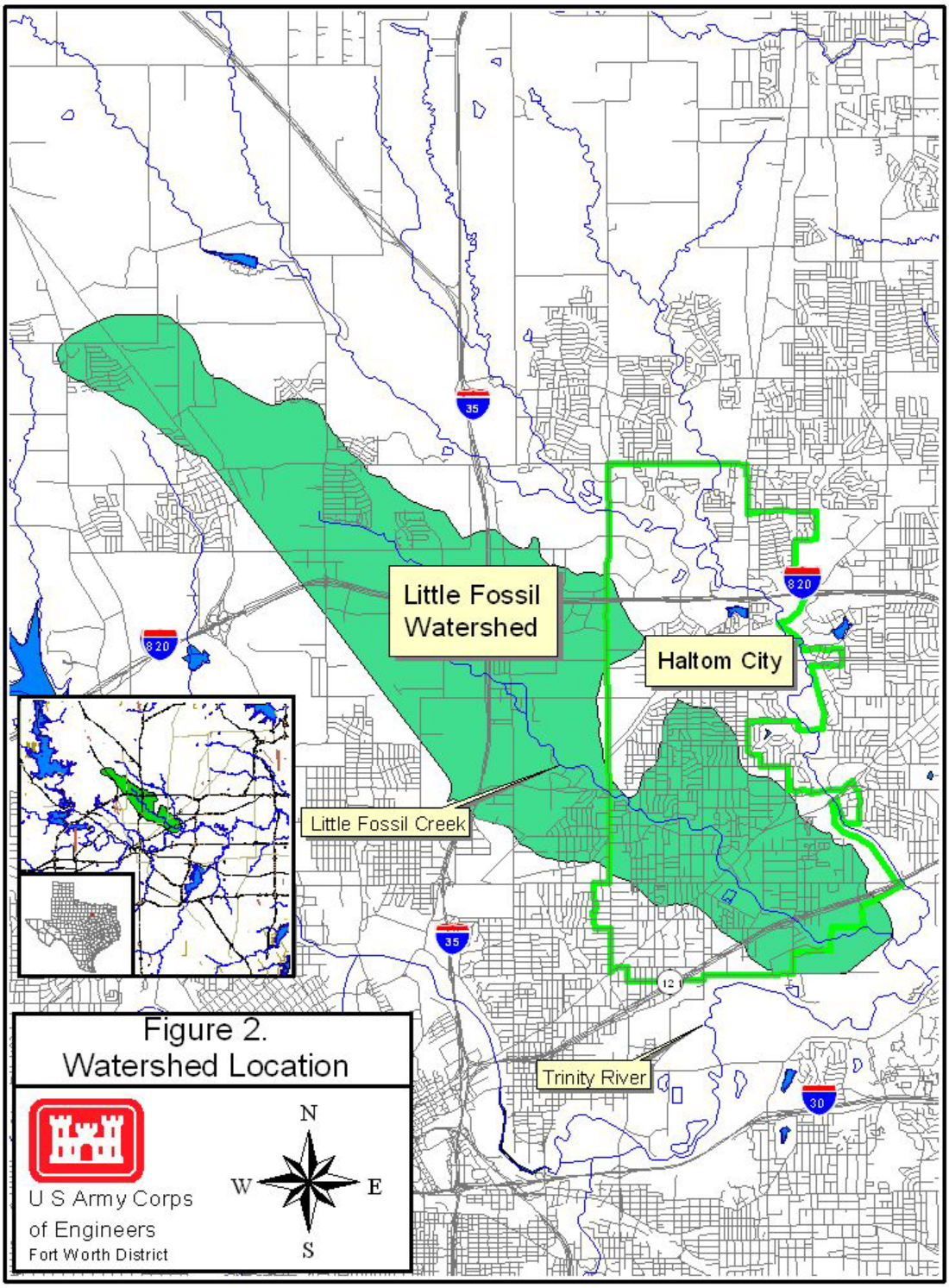


Figure 2.
Watershed Location

Although minor jointing is present in the limestone beds of the Pawpaw formation, there are no significant structural inconsistencies present within the immediate study area. The Little Fossil Creek study area lies within seismic zone 0, according to EM 1110-2-1902, dated 1 April 1970, subject: "Stability of Earth and Rock-Fill Dams." The creek bottom width varies from approximately 30 to 50 feet, primarily consisting of gravels and cobbles.

ENVIRONMENTAL SETTING

TERRESTRIAL RESOURCES

The Little Fossil Creek drainage basin is located in the transition area of the Cross Timbers and Prairies and Blackland Prairies ecological regions. Climax vegetation of the Cross Timbers and Prairies is Post Oak and Blackjack Oak woodlands mixed with native short to mid-grass prairie. Climax vegetation of the Blackland Prairie is true prairie midsize and tall grass.

General urban development in the Haltom City area has resulted in significant adverse impacts to wildlife habitat and wildlife food resources. Concurrent with the general impacts to wildlife in the Haltom City area, there has been a reduction in wildlife populations along Little Fossil Creek. The narrow riparian corridor along Little Fossil Creek, however, is one of few areas in Haltom City where any moderate quality wildlife habitat remains.

The terrestrial habitat along northern reaches of Little Fossil Creek in Haltom City, consist of a narrow, densely vegetated riparian corridor interspersed with old field and undeveloped open space. In the upper reach, the creek is tightly bordered on the east by urban dwellings and businesses, and mostly open space on the west. Throughout the bottom reach of the creek, south of Highway 121 to the now closed Trinity Waste Landfill, the riparian corridor expands significantly, contains fewer un-wooded stretches, and is not tightly bound by urban development. In the lower reach, there is a large, inactive, flooded, gravel quarry (approximately 20 surface acres).

The riparian corridor of Little Fossil Creek, although extremely narrow in areas, supports valuable wildlife habitat. Some of the more obvious forms of terrestrial habitat around Little Fossil Creek are vertical and horizontal snags, brush piles, burrows, and a lush assemblage of woody and herbaceous plant in the under- and overstory. The diversity of vegetation in the riparian corridor is moderate when compared to less urbanized locations around north Texas, but is very high when compared to other wooded or stream side areas around Haltom City. The Corps of Engineers and the Fish and Wildlife Service have extensively surveyed the proposed project site for natural resources. During the survey, the Pecan, Bur Oak, and Red Oak trees were the most common hard mast producing trees documented. Other trees observed in the study area included the Cottonwood, Cedar Elm, Green Ash, Black Willow, Box Elder, Hackberry, Red Mulberry, Fruitless Mulberry, Mesquite, Bois d' Arc, and Chinaberry. The understory and open space vegetation that was observed around Little Fossil Creek included: Ragweed, Buttonbush, Indian Cherry, Coralberry, Sideoats Grama, Virginia Creeper, Blackberry, Greenbriar, Little Bluestem, Johnson Grass, and Coastal Bermuda Grass.

North Texas urban riparian systems, like Little Fossil Creek, provide a habitat for a diverse group of wildlife species. The wooded habitat serves as protected travel corridors for mobile wildlife species and as refuge sites for urban wildlife species, such as passerine birds and small mammals. A natural resource site survey by the Corps and the Fish and Wildlife Service documented several reptiles, amphibians, birds, and mammals in the study area. A list of animals found in this survey is presented in Appendix C - Environmental Analysis (Table 1, Page C-2).

The aquatic habitat of Fossil Creek includes dead fallen timber, snags, rood wads, bridge pilings, undercut banks, limestone outcrops, and concrete rubble. In most reaches of the study area, there are overhanging trees and other bank vegetation that provides shade and organic

matter. There are many areas in Little Fossil Creek where the combination of slack water and fine sandy gravel substrate make ideal spawning conditions for fish. Sunfish and catfish are abundant and there is ample evidence that recreational fishing occurs throughout the system. Some documented water quality information is available for Little Fossil Creek; however, the wide range and diversity of aquatic organisms thriving in the stream would support that the levels of the water quality parameters necessary to support aquatic life (dissolved oxygen, ammonia, turbidity, etc.) are within ideal ranges. The aquatic organisms identified during a fish survey conducted by the Corps and the Fish and Wildlife Service are presented in Appendix C–Environmental Analysis (Table C-2, Page C-3).

AQUATIC RESOURCES

Existing Aquatic Conditions

The existing aquatic habitat structure within the proposed project channel area is composed of a repeating series of runs, riffles and pools. For evaluation of aquatic resources, the study area was divided into five reaches for determining existing aquatic habitat, determining features that could be avoided to minimize impacts, and to develop compensatory mitigation for unavoidable impacts. The reach designations were based upon existing channel bottom conditions and stream bank vegetation.

The first reach (See Figure 5) extends from the upstream end of the project below Belknap Street Bridge to Midway road. The channel bottom in this area is characterized by a series of shallow incised pools and steep-sloped riffles etched into a relatively stable limestone rock. The bank tops on both sides of the channel is forested in this reach.

The second reach extends from Midway Road to about 400 feet upstream of Thomas Street. The channel bottom in this reach is a mixture of rock outcrops and native soils. Only minor modifications to the bank have historically been made in this reach.

The third reach, extends downstream of the second reach to the Carson Street bridge. Others have straightened this reach by channelization, and the stream banks are vegetated with short grasses, dominated by coastal Bermuda grass. The channel bottom is earthen and continues to scour as the thalweg of channel tries to develop a sinuous pattern in response to the existing sequence of normal and high flows.

The fourth reach extends underneath the Carson Street/Highway 121 crossing and has been significantly disturbed in the past. The channel bottom and sides are armored with concrete. No important aquatic habitat occurs in this reach. The existence of other features including the 121bridge piers and fill associated with Carson Street reduce the available room for channel conveyance.

The fifth reach extends from the Highway 121/Carson Street area downstream to the end of the proposed flood damage reduction project at station 4650 or an approximate distance of 2,200 feet for this reach. Within this reach, the channel bottom is composed of soft shale and clays that become covered with gravels. The stream banks in this area are heavily wooded and the stream bed is shaded. The pools and riffles that form in this reach are of generally higher quality than in upstream reaches, although more transient in nature because of the softness of the hydraulic controls.

Measurements were made that provide information on the structural components of the aquatic habitat within the study reaches described. Within the overall length of stream a total of 12 runs, 21 pools, and 18 riffles were identified. At what is estimated to be a normal flow event, the wetted area associated with runs totaled 0.61 acres, pools totaled 2.55 acres, and riffle areas totaled 0.88 acres. Total channel bottom including the normally non-inundated areas of the study reach was estimated to be 4.04 acres. The average wetted width of the riffles was 21.7 feet. The

average width of the pools was 26.9 feet and the average width of the runs was 18.5 feet. The length of the riffles varied between 7 and 180 feet; the length of the pools varied between 17 and 396 feet and the length of the runs varied between 11 and 173 feet. Maximum depth of any stream component was 4 feet, which was in one of the existing pools. Riffle areas are generally inundated to only a few inches in depth and the runs are generally of uniform depth not exceeding 1 foot.

Future Aquatic Conditions (with No Action)

Significant urban development of the upper portions of the watershed above the study area has resulted in impervious conditions that have led to increased flooding depths as well as increased duration of low flow events. Channel modifications have been implemented as indicated in the description of existing conditions to provide some relief from flooding and to reduce erosion. Continued development is anticipated in the upper part of the watershed and intensification of development in the mid- and lower portions of the watershed is also projected to occur. This urban development would likely continue to cause additional but minimal bank and streambed erosion in reaches two, three, and five. With erosion of the banks, the channel bottom would likely increase slightly with time, but total wetted area at normal flows would likely be similar to what was found during evaluation of existing conditions.

FISH AND WILDLIFE

Little Fossil Creek is slightly meandering with bottom widths ranging from 30 to 50 feet and depths of 1 to 5 feet. It is comprised of a gravel and cobble bottom with varying side slopes. In the past, Haltom City has made several attempts to reduce flooding by channelizing various portions of the creek. North Texas urban riparian systems, like Little Fossil Creek, provide habitat for a diversity of wildlife species. The wooded habitat can serve as protected travel corridors for mobile wildlife species and refuge sites for urban wildlife species, such as passerine birds and small mammals. A natural resource site survey by the Corps and the Fish and Wildlife Service documented several reptiles, amphibians, birds, and mammals in the study area. A list of animals found in this survey is presented in Appendix C, Table C-1.

THREATENED AND ENDANGERED SPECIES

The U.S. Fish and Wildlife Service's (USFWS) latest published version of threatened and endangered species was consulted to identify those plants and animals that may occur in the project area. According to the Fish and Wildlife Service, there are three species on the Federal threatened or endangered list that are likely to occur or have been known to occur within the vicinity of the proposed project area. These species are the Interior Least Tern, Whooping Crane, and Mountain Plover.

STATE OF TEXAS SPECIAL SPECIES AND CRITICAL HABITATS

The only plant species listed on the Endangered, Threatened, and Watch List for Tarrant County, Texas, is the eared false-foxglove. Animals on the Endangered, Threatened, and Watch List, statewide for Texas, are the Texas Horned Lizard, Milk Snake, Bald Eagle, Golden Eagle, and the Merlin.

CULTURAL RESOURCES

Geo-Marine, Inc. of Plano, Texas, a private firm under contract with the Fort Worth District, has surveyed the Little Fossil Creek drainage for cultural resource properties. The on-line electronic Texas Archeological Sites Atlas was utilized in February 2000 to determine the locations and records of any known cultural resources sites and possible National Register of Historic Places (NRHP) properties within the study area. No records exist indicating the known

presence of historic buildings, structures, archeological properties, traditional properties, or the presence of burials associated with historic or prehistoric Native American Indian occupation of the region, within the project area. No previously recorded archaeological properties have been documented within the area of anticipated impact. Through intensive pedestrian survey, shovel testing, and geo-archaeological sampling of accessible portions of the project area, Geo-Marine identified 21 structures within the proposed project area. Twelve of these structures appear to predate 1950, but many could not be thoroughly assessed due to lack of right of entry. However, the structures are neither architecturally outstanding nor are they the representative work of a significant designer or craftsman. Therefore, they are not considered to be eligible for inclusion in the National Register of Historic Places. In addition, one substantial collection of early 20th Century tractors and farm equipment and one large trash and deadfall deposit were observed. No other cultural resources were found or identified.

HAZARDOUS, TOXIC AND RADIOLOGICAL WASTE (HTRW)

A records search for known HTRW sites was conducted for the study area, with specific emphasis on areas adjacent to the Little Fossil Creek channel. Also, a visual inspection was performed to ascertain the existence, if any, of seeps, discolorations in soil and water, dead vegetation, signs of dumping and/or filling, strange odors, and any other general indication of the presence of hazardous waste conditions.

The records search as well as the visual inspections found no indication of potential hazardous, toxic, or radiological wastes which would impact a potential project. Expansion of the limits of study to address additional components such as mitigation areas or disposal areas may be required in future phases.

RECREATION

LOCAL RECREATIONAL RESOURCES

The accumulated park and open space area within the corporate limits of Haltom City is approximately 74.3 acres (See Appendix J, Map 1). The Haltom City park and open space system is composed of 1.3 acres of playgrounds, 23 acres of neighborhood parks, and 50 acres of community parks. No regional parks exist in this area. The total park and open space area within the service area, including Haltom City and surrounding cities within a reasonable distance, was determined to be approximately 172 acres. Although Haltom City is currently experiencing a deficit in park facilities, the City contains some raw assets ready to be developed and utilized. The main undeveloped assets in the city are the Big Fossil and Little Fossil Creek floodways. Both creeks are conducive to development as "Greenbelts”.

REGIONAL RECREATIONAL ACTIVITIES

The per capita outdoor recreation participation generated by Region 4 residents in each of 26 activities was projected by the Texas Outdoor Recreation Plan for 1995 and can be found in Appendix J, Table J-2. This closely matches the statewide figures, with the exception of the saltwater activities, in which Region 4 residents are less likely to participate as a whole. Table J-2 also shows the activities garnering the most participation per capita. The top five activities that people do most frequently are walking, bicycling, pool swimming, playground use, and jogging. The state averages showed the same top activities. Compared to the state rates per capita for the 26 activities, Region 4 residents participate at higher rates for 7 activities, at the same rate for 5 activities, and at lower rates for 14 activities. Soccer and tennis participation in Region 4 is higher than almost all other regions.

SOCIO-ECONOMIC CHARACTERISTICS

Haltom City is located within Tarrant County in North Central Texas and spans an area of about 12.3 square miles. The city is northeast and adjacent to the city of Fort Worth. Approximately 72 percent of the city is developed with an average residential value of $60,200. The Bureau of the Census reported the population for Haltom City as 29,014 persons in 1980 and 32,856 persons in 1990. These figures accounted for about 3 percent of the population in Tarrant County. The 2000 population of about 37,400 persons renders an annual growth rate of 1.3 percent over the past decade.

Employment in Haltom City is nearly equal in distribution among the service manufacturing industry (17.5%), light manufacturing (17.3%) industry, and professional services (16.5%). The major private employers include Progressive Concepts, Inc, Andrews Transport, Inc., State Fair Foods, MICA Corp., and Revcor Molded Products.

The Workforce Commission reported Forth Worth-Arlington area unemployment in 1994 at 5.6 percent. In 1996, the unemployment declined to 3.9 percent and for 1999 is reported by the commission at 3.1 percent. The median household income exceeds $35,000. The median income for families exceeds $42,000. Interstate Loop 820 facilitates transportation in the city with Interstate 35 just 11 miles northwest. State Highways 121 (Airport Freeway) and 26 (Grapevine Highway) and U.S Highway 277 provide excellent access to the entire Dallas-Fort Worth Metroplex as well as to the Nation. State Highway 121 (Airport Freeway) is a north-south freeway in the eastern sector that provides an efficient 20-minute connection to the DFW International Airport. Three rail lines, including Union Pacific, Trinity Railway Express, and Fort Worth and Western Railroad, serve the city.

FLOODING EXPERIENCES

HISTORY OF FLOODING

Flooding along Little Fossil Creek occurred in 1957, 1958, 1959, 1968, 1975, 1977, 1981, 1982, 1989, 1991, and 1992. The October 1981 flood event is the flood of record, and resulted in an estimated $10 million in flood damages (1981 prices). The 1968 flood event resulted in the loss of life when a vehicle was swept off a bridge.

FORT WORTH STAR-TELEGRAM, FRIDAY – JULY 25, 1975

THE WET LOOK — Tarrant County residents waded this morning at Dana and Beach streets after Fossil Creek overflow flooded the intersection. In the background, several men helped push a car out of the deep water. Some homes were threatened by high water in the area.

Rescues Abound as Water Leaves Little Fossil Banks

HALTOM CITY — Several dozen residents today were rescued from flooded homes and stranded automobiles in low-lying sections throughout Haltom City after heavy rains caused Little Fossil Creek to rise the highest it has in 10 years.

High water was also reported in some sections of Richland Hills, Watauga, North Richland Hills and Euless after five to six inches of rain fell early today.

Haltom City Fire Chief Bill Davis, who reported no injuries or drownings said the water was beginning to recede by 10 a.m.

DAVIS SAID more than 100 city employes worked to rescue people from houses and cars and also to barricade streets in all sections of the city where there was high water.

Mrs. Janell Jones was one of six persons rescued from Fincher Street, where Little Fossil Creek runs nearby.

"Within 30 minutes, the water along the driveway rose to where it was about waist-deep," Mrs. Jones said. "I called the rescue squad and they came and got me."

Mrs. Jones said that water had seeped into the front and back sections of the house, just enough to ruin the carpets.

Robert Bartee, 14, of Richland Hills was rescued by firemen today as he floated down Little Fossil Creek in an innertube.

A RICHLAND Hills police dispatcher said Bartee, of 5525 Kingsbury, was swimming in the creek when he encountered deep water.

Several automobiles were stranded in high water and Davis reported one man was rescued by rope from his stalled pickup truck.

In Euless, a car was stranded on Airport Freeway near the Forum Drive Bridge and three cars collided when the car stalled. No injuries were reported.

High water washed one dump truck off U.S. 377 in Watauga and eight to 10 cars were stranded at a dry weather crossing on Watauga Road about one mile west of U.S. 377.

Watauga firemen sandbagged six houses near a drainage ditch that runs behind Watauga Junior High School when residents reported water in the homes.

Several police dispatchers said the heavy rains resulted in Little Fossil Creek rising the fastest it has in 10 years.

HIGH WATER—Haltom City residents are waist-high in water that spilled over the banks of Little Fossil Creek Friday morning, causing considerable property damage to homes and cars.

APPROPRIATE SIGN . . . Car sits in lake-like street near Fossil Creek

FLOODED HOUSE . . . An unidentified man watches water recede while holding on to a fireplug

PATTERN OF FLOODING

The existing conditions flow path for Little Fossil Creek contains a diversion around State Highway 121 for flood events equal to or greater than the 10-year event. The diversion extends eastward and passes under State Highway 121 at Minnis Drive and rejoins the creek approximately 4,000 feet downstream.

ECONOMIC FLOOD DAMAGE ANALYSIS

GENERAL

The principal purpose of these economic analyses was to identify the extent of the flood problem and, on a comparable basis, evaluate solutions to reduce flood losses. The analysis conducted led to the estimation of expected benefits of proposed flood reduction plans using a risk and uncertainty analysis. As part of these activities, a field survey was conducted to identify the numbers and types of property, as well as the value of the investment affected by flooding. Calculations were performed to develop estimates of the damages and benefits assignable to the various flood protection plans investigated. Estimates of existing flood damages reflect May 2000 prices and level of development.

Flood Profiles and Delineation

A full range of water surface profiles, based on existing stream conditions, were developed for this study. These profiles were used to delineate the floodplain limits and determine the relationship of damageable properties to both elevation and frequency of flood occurrence. The satisfactory development of the hydraulic model was a multi-stage iterative process, with the reasonableness of the resulting economic effects being used to assist in refining the hydraulic models used.

Data Collection

In May 1987, an inventory was made of the floodplain lands along the subject stream to identify existing floodplain development. The inventory included enumeration, classification, and value estimation of the numbers and types of structures within the SPF limits. Existing damageable properties were classified into seven major damage categories, as shown in Table 1. This inventory was field-checked in January 1996 and in March 2000 to update and verify values, location, and floor elevations.

A determination of the value of floodplain investment (structures and contents) for each major damage category was based on data provided by the Tarrant County Tax Appraisal District. These data were reviewed by the Real Estate Division personnel in Fort Worth District and considered representative of the depreciated replacement value of each structure, net of the value of associated lands. The value of existing residential contents was estimated at 50 percent of the structure value based on a 1993 survey of properties damaged in previous floods in Dallas and Tarrant Counties. The values of contents for the other damage categories were based on direct field observation and interviews with property owners, and the relationship between structure and content values observed in prior studies within Tarrant County.

Table 1
Major Damage Categories

Damage Category	*Activity Description*
Residential	Single and multifamily dwellings
Commercial & Industrial	Retail and wholesale businesses
Flood Insurance Admin.	Public costs of flood insurance program
Public	Public and quasi-public structures
Transportation	Streets, Highways, And Bridges
Communications & Utilities	Electrical, gas, telephone, sewerage, and water supply facilities and buildings
Public Health and Relief	Flood-fighting and emergency management

Probabilities of Flood Events. Corps of Engineers policy (as per ER 1105-2-101) states, “The estimate of NED benefits and costs will be reported as a single expected value and on a probabilistic basis for each planning alternative.” This requires the classical nomenclature describing the relative risk of given flood events to be changed to reflect the actual probability, rather than the average recurrence interval, of flood events. For example, the commonly used term "100-year frequency flood", meaning that flood which has a one percent chance of being equaled or exceeded in any given year period will hereafter be described as the “1 percent annual chance exceedance (ACE) flood.” For convenience, this probabilistic nomenclature will be abbreviated as "1-percent ACE flood.”

Reach Determination. The area surveyed included all properties lying within the 0.2 percent ACE (500-year event) floodplain along Little Fossil Creek extending from the confluence of the Trinity River northwest to Walthall Street. The area was divided into six reaches based on economic and hydrologic considerations. Table 2 provides a description of the reach locations, stationing and index points used in this investigation, while a map of the study area with reach designations is shown in Figure 3.

FIGURE 3. MAP OF STUDY REACHES

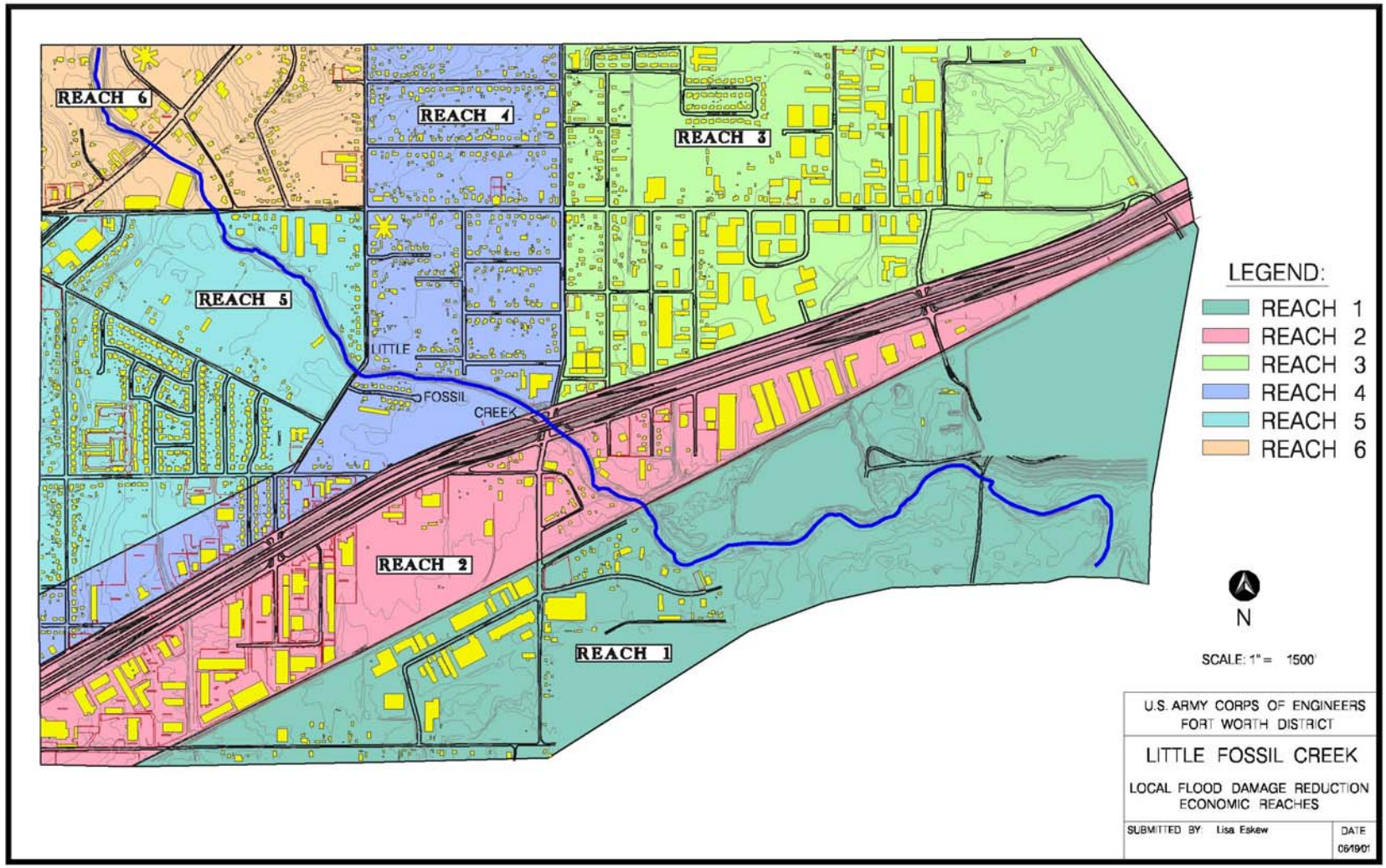


Table 2
Little Fossil Creek Study Area
Reach Descriptions and Stationing

Study Reach	Reach Description	Upper Station	Lower Station	Index Point
1	Below Railtran Bridge	5749	300	5030
2	Area between RR and Airport Freeway	7285	5750	6550
3	North of Airport Freeway (Splitflow area) East of Carson St. to Big Fossil	4879	446	2489
4	Carson St. (West) to Thomas Rd.	8978	7286	8450
5	Thomas Rd. to Midway Bridge	11280	8979	10348
6	Midway Bridge to Walthall Street	11218	11281	11630

Structures and Investment Identified. Table 3 displays the number of structures at risk of flooding by flood zone and reach. Field investigations identified 803 damageable structures within the 0.2 percent ACE (500 year) floodplain of Little Fossil Creek. These structures have a total estimated investment value of $108.2 million, based on May 2000 prices and level of development.

Over 74 percent of the number of structures represents residential dwellings. Residential structures, contents and vehicles comprise about 41 percent of the investment value of the Little Fossil Creek 0.2-percent ACE (500 year) floodplain. Most of these are one or two-story detached residences, which have an average structure value of about $73,000. Approximately 300 structures, or 37 percent of the total number of structures, are found within the 10-percent ACE floodplain. About 78 percent of the total number of structures is situated within the 1-percent ACE floodplain.

Table 3
Enumeration of Structures
By Reach and Flood Zone

Reach	Annual Chance Exceedence Event					
	20% (5-Yr)	10% (10-Yr)	4% (25-Yr)	2% (50-Yr)	1% (100-Yr)	.2% (500-Yr)
1	0	1	8	18	40	78
2	7	23	32	35	39	52
3	0	11	71	96	127	177
4	0	83	111	132	150	204
5	0	167	197	221	235	254
6	0	15	22	28	33	38
Zone Total	**7**	**300**	**441**	**530**	**624**	**803**

Single-Occurrence Flood Losses. Under existing conditions, significant damages begin with a 20 percent ACE discharge. It is estimated that a 0.2-percent ACE (500 year) event could cause direct structure and content damages of approximately $34.7 million based on May 2000 prices. This would represent a loss of about 35 percent of the total investment in the Little Fossil Creek 0.2-percent ACE (500 year) floodplain. The 1-percent ACE (100 year) event could produce losses of about $28.5 million and the 10 percent ACE (10 year) event would cause damages that exceed $6.6 million. Table 4 presents detailed estimates of flood losses for selected single-occurrence flood events, by property type.

Existing Condition Expected Annual Damages. Estimates of expected annual damages (EAD) under existing conditions were calculated, using the risk and uncertainty model, through integration of frequency-damage data. The expected annual flood losses in the study area totaled nearly $2.1 million based on May 2000 prices, of which 77 percent is associated with residential development. A breakdown of existing average annual damages by property type and reach is presented in Table 5.

Table 4
Cumulative Estimate of Single Occurrence Flood Losses To Structures, Contents Under Existing Conditions
(based on May 2000 prices and level of development)
(1,000's of $'s)

Reach	Exceedence Event						EAD
	20% (5-Yr)	10% (10-Yr)	4% (25-Yr)	2% (50-Yr)	1% (100-Yr)	0.2% (500-Yr)	
1		$ 2	$ 233	$ 1,199	$ 2,876	$ 4,950	**$ 76**
2	$ 209	$ 1,066	$ 2,517	$ 3,122	$ 3,898	$ 4,423	**$ 328**
3		$ 57	$ 2,691	$ 5,125	$ 7,517	$ 10,016	**$ 316**
4		$ 916	$ 3,030	$ 3,424	$ 4,395	$ 5,276	**$ 336**
5		$ 4,040	$ 6,379	$ 7,435	$ 7,435	$ 7,435	**$ 885**
6		$ 584	$ 1,118	$ 1,676	$ 2,347	$ 2,576	**$ 150**
Total	$ 209	$ 6,664	$ 15,969	$ 21,982	$ 28,468	$ 34,676	**$ 2,091**

Table 5
Estimated Expected Annual Damages Under Existing Conditions
(based on May 2000 prices and level of development)
(1,000's of $'s)

Study Reach	Expected Annual Damages					EAD
	Single-Family	Multi-Family	Mobile Homes	Commercial	Public	
1	$ 30			$ 40	$ 6	**$ 76**
2	$ 44		$ 1	$ 281	$ 2	**$ 328**
3	$ 40			$ 275	$ 1	**$ 316**
4	$ 279			$ 56		**$ 336**
5	$ 715	$ 72		$ 97	$ 1	**$ 885**
6	$ 59			$ 91		**$ 150**
Total	$ 1,168	$ 72	$ 1	$ 840	$ 10	**$ 2,091**

PLAN FORMULATION

GENERAL

Plan formulation is the process of developing and evaluating alternatives that meet planning objectives and avoid planning constraints. This section details the process of stating the planning objectives and constraints, the initial screening of measures, the evaluation of alternatives, and the selection of the recommended plan.

Legislation requires that Federal water and related land resources projects directly contribute to the National Economic Development (NED) in a manner consistent with protecting the Nation's environment. Contribution to NED is achieved by increasing the net value of the Nation's output of goods and services, expressed in monetary units. NED contributions must also consider environmental quality as pertaining to the effects of proposed changes on ecological, cultural, and aesthetic attributes of significant natural and cultural resources not measured otherwise.

Plans formulated as part of this study were evaluated based on their contribution to the Federal objectives of NED and are consistent with protection of the Nation's environment. In addition to these National objectives, additional planning objectives have evolved from interviews with area residents, from contact with City, State, and Federal agencies, and from observations made in the area. The planning objectives, which specifically identify the needs, desires, and goals of the community for the Haltom City study area, are stated below.

PLANNING OBJECTIVES

Planning objectives are an expression of public and professional concerns about the use of water and related land resources resulting from the analysis of existing and future conditions in the study area. The planning objectives for the period of analysis between the years 2005 to 2055 are as follows:

- Reduce flood damages to structures and their contents as well as vehicles along Little Fossil Creek within Haltom City.

- Reduce the potential for loss of life associated with inundation, high velocities, isolation, and/or overtopping of roads and bridges along Little Fossil Creek within Haltom City.

- Reduce flood damages to public facilities such are roads, bridges, utilities, schools, churches, etc. along Little Fossil Creek within Haltom City.

- Reduce the public and private costs associated with flood fighting and recovery along Little Fossil Creek within Haltom City.

- Reduce the disruption and costs associated with the closure of highways and streets along Little Fossil Creek within Haltom City.

- Reduce business and commercial losses resulting from a loss of production and/or economic activity for establishments along Little Fossil Creek within Haltom City.

- Improve the overall health, safety and quality of life of the citizens of Haltom City, the State of Texas, and the United States of America.

- It is the City's desire to provide the citizens of Haltom City the level of flood protection that is now considered a standard. This equates to complete protection from a 100-

year storm event (1% ACE), as defined by the Federal Emergency Management Agency.

- Protect and restore riparian habitat and open space for public use, consistent with reduction of flood damages

PLANNING CONSTRAINTS

In development of the flood damage reduction alternatives, the following constraints or limitations were identified to direct plan formulation efforts such that beneficial impacts would be maximized and adverse impacts would be minimized:

- Alternatives will be limited to the study area within Haltom City along Little Fossil Creek.

- The formulation of alternatives that reduce flood damages and costs in one area should not result in measurable increases in the extent and magnitude of flooding in another area.

- The formulation of alternatives must avoid adverse impacts to significant ecological resources; and if avoidance is not feasible, then adverse impacts to ecological resources must be minimized. Unavoidable adverse impacts to ecological resources must be mitigated.

- The formulation of alternatives must avoid adverse impacts to significant cultural resources; and if avoidance is not feasible, then adverse impacts to cultural resources must be minimized. Unavoidable adverse impacts to cultural resources must be mitigated.

- The formulation of alternatives should avoid areas that are either known or suspected to be contaminated and/or contain hazardous, toxic, and radioactive waste.

- The formulation of alternatives should avoid adverse impacts to structures.

- The formulation of alternative should avoid adverse aesthetic and visual impacts.

- Total annual benefits must equal or exceed total annual costs for a plan to be implemented.

- The recommended plan must be generally acceptable to the public.

- The recommended plan must have a local non-Federal sponsor.

- Combined Federal expenditures on the planning, design, and implementation of the recommended plan shall not exceed $7.0 million, if possible. This is the current limit for projects authorized under Section 205 of the Flood Control Act of 1948, as amended.

PLAN FORMULATION RATIONALE

Plans are formulated to meet planning objectives and avoid constraints. The following paragraphs discuss the technical, economic, environmental, and social criteria used to develop the formulated alternatives to meet the stated study objectives.

TECHNICAL CRITERIA

In order to develop a plan that would satisfy the primary objective of reducing flood damages and costs within the study area, the following technical criteria was adopted for use in developing, evaluating, and comparing alternative plans:

- The plan should be effective and efficient with regard to alleviating the specified problems and achieving the specified goals.
- The plan must be technically feasible using engineering methods and equipment available in the study region.
- Plans should be adequate to provide a project life of at least 50 years.
- Existing facilities should be utilized to the maximum extent possible.
- The plan is to be complete within itself and not require additional future improvements other than normal replacements, and operation and maintenance.
- The plan is to be formulated using engineering criteria taken from appropriate Corps of Engineers' engineering and design manuals and regulations related to flood damage reduction alternatives.

ECONOMIC CRITERIA

The National Economic Development (NED) objective is the maximization of the economic worth of alternative plans as set forth in *Principles And Guidelines For Water And Related Land Resources Implementation Studies*. The NED objective is to increase the nation's output of goods and services and improve economic efficiency. For flood damage reduction projects, this objective relates to a plan's capability to prevent flood damages and costs (economic benefits). The amount that a project's economic benefits exceed the project cost (when both are expressed in annual terms) is defined as the net benefits of the plan. In the plan formulation process, the plan that meets the planning objectives and avoids the planning constraints, and yields the greatest net benefits, best meets the objective of NED.

Economic feasibility of a plan is measured as a relationship of benefits-to-costs. Benefits are the monetary savings due to damages prevented, reduction in the cost of emergency services, and the reduced disruption of the local economy. These benefits are subsequently annualized to represent a yearly benefit applicable for the life of the project. The project costs, are also annualized so as to represent an annual project cost, applicable for the analysis period of the project. The annual benefits and the annual costs are then related in a benefits-costs ratio (BCR). To be economically feasible, a plan must have benefits which equal or exceed costs, i.e., a BCR equal to or greater than 1.0.

To meet the Federal guidelines for planning water resource projects, the following economic criteria were followed:

- All plans must be economically feasible, which dictates that the plan's flood reduction benefits must exceed the cost of the plan. Measures for mitigation, restoration, and protection of environmental resources must be justified based on a combination of tangible and intangible benefits.
- The alternative being selected as the recommended plan should reasonably maximize benefits over costs consistent with protecting the Nation's environment, while meeting the planning objectives and avoiding the planning constraints. Each

separable unit or purpose of a given alternative must provide benefits at least equal to its costs.

- Alternatives will be evaluated using the current price level, a 50-year period of analysis, and the current Federal discount rate for water resource projects as determined by the U.S. Department of Treasury.

- Annualized costs include the cost of operation, maintenance, repair, replacement, and rehabilitation (OMRR&R).

ENVIRONMENTAL AND SOCIAL CRITERIA

Plans formulated under federal directives should be consistent with protecting the existing environment by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems in the proposed project area. Ecosystem restoration is one of the primary missions of the Corps of Engineers Civil Works program, with the objective of contributing to the national ecosystem restoration. However, for this feasibility study, the sponsor has not requested that ecosystem restoration be pursued, either as a single purpose or multipurpose project.

Structural and nonstructural flood damage reduction measures must be evaluated in accordance with guidelines established by the National Environmental Policy Act of 1969 (Public Law 91-190), as amended, and the P*rinciples and Guidelines for Water and Related Land Resources Implementation Studies*, as developed by the U.S. Water Resources Council, dated July 1983. The following environmental and social criteria were considered:

- Protect against possible loss of life, property, and hazards to the health and safety of area residents, and preserve, maintain, or enhance community cohesion and desirable community and regional growth.

- Preserve and/or enhance social, cultural, educational, and aesthetic values as well as historical and cultural attributes of any sites within the project area.

- Promote the development of areas of natural beauty and human enjoyment and protect areas of valuable natural resources.

INITIAL SCREENING OF MEASURES

In selecting alternative plans for flood damage reduction, a full range of structural and nonstructural measures were considered.

Structural measures consist of structures designed to control, divert, or exclude the flow of water from the flood prone areas to the extent necessary to reduce damages to property, hazard to life or public health, and general economic losses. The structural measures considered most appropriate in dealing with the character of the flood problems encountered typically include small detention lakes, channel modifications, flood flow diversions, and levees.

Nonstructural measures, attempt to avoid flood damages by exclusion or removal of damageable properties from the flood prone areas. These measures do not affect the frequency or level of flooding within the floodplain; rather, they affect floodplain activities. The technique of controlled land use is particularly helpful in planning for future development, but is limited in highly developed areas.

The basic alternative to any flood damage reduction plan is the no action plan. Adoption of this alternative implies acceptance of the costs and adverse effects of continued flooding. The no action alternative would recommend no plan and require no allocation of Federal funds.

Certain alternative solutions have been subjected to only preliminary investigations because of their evident economic infeasibility, social unacceptability, or increased adverse impacts on the environment. The more favorable alternative solutions have been subjected to more detailed studies to define their costs and benefits.

NONSTRUCTURAL MEASURES

No Action

The "no action" alternative would not recommend any type of project, nonstructural or structural, be implemented. While the no-action measure does not require the expenditure of Federal funds, adoption of this alternative implies acceptance of the existing and future flood damages and other adverse impacts caused by continued potential flooding of the 803 structures within the 0.2 percent ACE (500 year) floodplain. Although flood insurance would partially compensate for flood damages, they would still be incurred at an estimated average rate of $2.1 million annually. The costs for flood fighting and recovery costs, public damages, the potential loss of life, and the overall threat to health and safety would continue under the no action alternative. The no action alternative does not meet the previously stated planning objectives, and therefore, is eliminated from further consideration.

Floodplain Management

Floodplain management is most effective in controlling future development of the floodplain, thereby assuring that the existing flood problems do not become worse. However, floodplain management cannot, by itself, significantly alleviate existing flooding conditions within an existing floodplain. The technique of controlled land use is particularly helpful in planning for future development but is of limited use in highly developed areas. Effective regulation of the floodplain is dependent on developing enforceable ordinances to insure that floodplain uses are compatible with the flood hazard. Several means of regulation are available, including zoning ordinances, subdivision regulations, and building codes. Zoning regulations permit prudent use and development of the floodplain in order to prevent excessive property damage, expenditure of public funds, inconvenience, and most important of all, loss of life, due to flooding. Subdivision regulations guide the division of large parcels of land into smaller lots, and typically require the developer to show compliance with subdivision regulations, zoning ordinances, the local land use or master plan, and other regulations. A subdivision ordinance would require installation of adequate drainage facilities, prohibit encroachment into floodway areas, require the placement of critical streets and utilities above a selected flood elevation, and building lots or structures above a selected flood elevation, normally one foot above the 100-year floodplain elevation. Building codes specify the building design, materials and construction methods used for both construction of new buildings or repair of flood-damaged structures.

Haltom City currently participates in the National Flood Insurance Program (NFIP), and has been enrolled in NFIP's Regular Program since 1975**.** After joining this program, Haltom City has enacted and enforced numerous floodplain land-use restrictions, regulation, zoning ordinances, subdivision regulations, and building codes. While these measures will not reduce flood damages to the majority of the existing structures in the study area, they are important management tools. Regardless, this does not warrant further evaluation due to its inability to address existing damages. It should be noted that Haltom City will be required to complete and implement a floodplain management plan within one year of the completion of any flood damage reduction plan recommended and implemented by the Corps of Engineers.

Flood Forecast and Warning

Flood forecast and warning involves the determination of imminent flooding, implementation of a plan to warn the public, and organization of assistance in evacuation of persons and some personal property. Notification of impending flooding can be by radio, siren, individual notification, or by more elaborate means such as remote sensors to detect water levels and automatically warn residents. These measures normally serve to reduce the hazards to life and damage to portable personal property. Flood warning and emergency evacuation should be considered as part of any flood control plan. However, due to the short warning time on Little Fossil Creek, a flooding forecasting alternative would not represent a viable flood damage reduction measure, and therefore is not considered further in this study.

Flood proofing

Flood proofing of residential and commercial structures can include providing water tight coverings for door and window openings, raising structures in place, raising access roads and escape routes, constructing levees and floodwalls around individual buildings or groups of buildings, and waterproofing walls of structures. Flood proofing is more easily applied to new construction and more applicable where flooding is of short duration, low velocity, infrequent, and of shallow depths, and is also appropriate in locations where structural flood protection is not feasible or where collective action is not possible. Flood proofing techniques would require major modifications to existing structures. For water levels that are lower than the first floor of a home, flood proofing would certainly be a possibility. However, if a sustained water level in excess of one foot of the first floor elevation, the structural stability of a watertight home becomes a critical factor. A flood proofed structure generally cannot withstand hydrostatic pressures when water rise three feet above the lowest floor. In addition, flood proofing introduces uncertainties in the degree of protection, since the owner must be present (or awake) to close off windows, doorways, etc. Additional shortcomings include not protecting public facilities such as roads, bridges, and utilities, and the continued threat of road closures and the isolation of residents trapped in their homes and businesses. While flood proofing would not likely result in any significant or permanent adverse impacts to ecological or cultural resources, and is appropriate under certain conditions, it does not address the planning objectives or criteria previously discussed. Therefore, flood proofing will not be considered further in this study.

Floodplain Evacuation

Floodplain evacuation, or buyout as it is commonly known, involves the acquisition, demolition, and removal of structures from the floodplain, and the relocation of residents to flood-free housing. The practicality of evacuation depends on several factors. They include the frequency and severity of flooding, the willingness of residents to move out of the floodplain, the availability of flood-free housing, the value of the property, and the need for areas of a more compatible floodplain use such as parks or nature areas. Permanent evacuation is a very effective means of reducing flood damages, as well as public damages and costs.

Past investigations have demonstrated that permanent evacuation is typically cost effective only up to and including the 10% ACE (10 year) floodplain. Within the study area, there are a total of 300 structures within the 10% ACE (10 year) floodplain. Based on this assessment alone, permanent evacuation warrants further investigation, and will be developed in more detail.

STRUCTURAL MEASURES

Detention

This alternative consists of constructing one or more structures to provide flood storage to detain peak flood flows and lessen downstream flood damages. Detention is used to temporarily impound floodwaters for later release when the downstream conditions permit. The feasibility of

this measure depends heavily on the volume and timing of the flood flows, and the availability of an impoundment site capable of providing sufficient storage. A scan of the watershed area above the damage centers in Haltom City was performed. However, no suitable area was found which could be used as a detention site. Therefore, this alternative was not considered any further.

Levees and Floodwalls

Levee systems traditionally provide high levels of protection to flood prone areas but often require substantial amounts of real estate between the stream and the structures being protected unless an existing levee is in-place and only a small strip of real estate is required. Floodwalls (usually made of concrete) are used in lieu of levees in situations where the acquisition of real estate for the levee or other topographic problems may be prohibitive. The feasibility of either of these measures is based on the cost and availability of real estate, the number of structures along the levee alignment, and the additional costs necessary to alleviate interior drainage problems to prevent induced damages in adjacent areas. Construction of individual levees or floodwalls around specific structures or small groups of structures is normally considered cost prohibitive unless the individual structure is very valuable, has cultural significance, or is prone to frequent flooding.

A levee system alternative was considered in the study area. However, the proximity of structures and the lack of available space make a levee physically infeasible because of the anticipated high relocation cost associated with removal of the structures where the levees would be constructed. Floodwalls, which require less real estate acquisition, are historically much more expensive than any other alternative, either structural or nonstructural. Based on the value of the properties to be protected, and considering the length of the reach, the floodwall alternative would be prohibitively expensive. The non-Federal sponsor and residents of the area expressed that this was not a desirable solution to the flooding problems, due to the adverse aesthetics of this alternative. Therefore, levees and floodwalls were eliminated from further consideration.

Hydraulic Channel Improvements and/or Bridge Modifications

This measure consists of modifying an existing channel by either increasing the cross-sectional area of the stream channel and/or an existing bridge (widening and/or deepening), straightening and realigning the stream channel, and/or reducing the friction losses of an existing channel through concrete lining. The design of the channel modification can vary significantly and is primarily based on the topography of the existing stream channel and the existing development of properties within the floodplain. Other factors to consider in the design of these hydraulic channel improvement alternatives include the existence of known or potential significant ecological and cultural resources as well as contaminated material.

Given the flood pattern in the study area where water escapes the confines of the channel in the reach from Midway Road to Carson Street, it appears that efforts to increase the capacity of the channel in this reach may be quite beneficial. Also, it appears that the Carson Street/Airport Freeway bridge complex is responsible for a substantial hydraulic head loss. Increasing the capacity of the channel through the complex would lower the head losses and allow for lower upstream water surface profiles for a given frequency.

The hydraulic channel improvement alternative investigated in the December 1987 reconnaissance study was a grass-lined trapezoidal channel, beginning near the confluence of the West Fork Trinity River and extending upstream a distance of about 10,000-feet. The channel had a bottom width of between 70 and 100-feet. The project first cost was estimated at $10.3 million. Annual costs and expected annual benefits were estimated at $962,900 and $2.0 million respectively, with a benefit-cost ratio of 2.1 (1987 prices, 8.625% interest). It is apparent that hydraulic channel improvements warrant further investigation.

DETAILED INVESTIGATIONS OF ALTERNATIVES

As a result of the initial screening of measures, two alternatives were identified to continue with more detailed investigations – the nonstructural permanent evacuation measure and the structural channel modification measure.

All structural and nonstructural plans were developed in accordance with the planning objectives, planning constraints, and plan formulation rationale as summarized in the section of this report, "Plan Formulation." Each alternative plan was evaluated for its magnitude in difference between without and with project conditions. This magnitude in difference was expressed in monetary terms (annual project benefits minus annual project costs) and identified as net benefits.

PERMANENT EVACUATION PLAN ANALYSIS

Permanent evacuation within the primary study area was selected for detailed evaluation. Feasibility was based on the resultant benefit-to-cost ratio (BCR) for selected exceedence events by reach. Buy-out plans were evaluated aggregately for the evacuation of residential structures within the 20, and 10 percent ACE flood events and for the 10 percent ACE with the Carson Street Bridge improvements. Table 6 displays the results of the nonstructural evaluation.

The 20 percent ACE evaluation identified only one residential structure within the targeted exceedence event. The structure is located in reach 3, and the first cost to buy-out this structure was estimated at about $70,000. The $5,000 in annual costs and claimable annual benefits of $7,000 results in a feasible BCR of 1.4 to 1.0 with net benefits of $2,000. Implementation of this alternative would not be a complete solution, because hundreds of structures located within relatively frequent flood zones remain susceptible to flooding.

The 10 percent ACE evaluation identified 254 residential structures within the targeted exceedence event. The structures are located in reaches 3 and 4, and the first cost to buy-out this flood zone was estimated at about $17.8 million, which is well above the Section 205 authority limits. The $1.4 million in annual costs and about $0.6 million in claimable annual benefits result in a BCR of 0.4 to 1.0.

The 10 percent ACE evaluation in combination with the Carson Street Bridge improvement identified 244 residential structures within the targeted exceedence event. The structures are located in reach 2, the first cost to buy-out this flood zone plus bridge improvement was estimated at about $20.5 million. The $1.5 million in annual costs and about $1.1 million in claimable annual benefits result in a BCR of 0.7 to 1.0.

Table 6
Economic Analysis Of Various Evacuation Plans
(based on May 2000 prices and level of development)
(1,000's of $'s)

	5-Yr Buyout	*10-Yr Buyout*	*Carson Bridge + 10-Yr Buyout*
INVESTMENT			
Estimated First Cost	$ 70	$17,780	$20,536
Annual Interest Rate	0.0663	0.0663	0.0663
Project Life (Years)	50	50	50
Construction Period (Months)	3	18	18
Investment Cost	$ 71	$18,663	$21,556
ANNUAL CHARGES			
Interest	$ 5	$1,236	$ 1,428
Amortization	$ 0	$52	$ 60
Operation/Maintenance ($/Year)	$0.3	$63.5	$ 61
TOTAL ANNUAL CHARGES	**$ 5**	**$1,352**	**$ 1,549**
ANNUAL BENEFITS			
INUNDATION REDUCTION	$ 7	$584	$1,107
NET BENEFITS	**$ 2**	**($769)**	**($442)**
BENEFIT-TO-COST RATIO	**1.4**	**0.4**	**0.7**

EVALUATION OF CHANNEL MODIFICATION ALTERNATIVES

Modification through Carson Street/Airport Freeway Bridge Complex

The undersized bridge openings through the Carson Street/Airport Freeway bridge complex have long been identified as a constriction to the flow of Little Fossil Creek. The constraints associated with this reach are clearly visible in the photograph that follows. The complex consists of the following bridges:

- Eastbound State Highway 121 Service Road Bridge - This concrete bridge is 133 feet long, 41' 4" wide and has a 36-degree skew. The bridge is approximately 15 feet high and has 2 horizontal to 1 vertical paved header slopes.

- Carson Street Bridge - This concrete bridge is 116.66 feet long, 59' 10" wide and has a 23-degree skew. The bridge is approximately 15 feet high and has 2 horizontal to 1 vertical paved header slopes.

- Westbound State Highway 121 Road Bridge - This concrete bridge is 133 feet long, 41' 4" wide and has a 36-degree skew. The bridge is approximately 15 feet high and has 2 horizontal to 1 vertical paved header slopes.

- State Highway 121 Overpass Bridges - These two parallel concrete bridges are 142.5' long, 59' wide and have a 31degree skew at the creek. The bridges are approximately 30' high and have 2:1 (Horizontal:Vertical) paved slope at the creek.


Carson Street, Service Road and State Highway 121 Bridges

As a result of the constriction through the bridge complex, a severe backwater exists, causing flood flows to overtop the perched creek bank, and split to the east just upstream of the northernmost bridge. As a channel modification alternative, the enlargement of the channel under the bridge complex to allow for the maximum allowable conveyance area without compromising the integrity of the bridge structure was evaluated. This analysis evaluated a modification of the creek channel from the existing 55-foot bottom width channel with 1:2 (Vertical:Horizontal) side slopes to a 105-foot bottom width concrete channel with vertical walls.

The estimated first cost of this alternative is $3.46 million, with an average annual cost of $271,000. Total annual flood benefits were estimated to be $524,000, resulting in a benefit-cost ratio of 1.9, and net benefits of $253,000.

Comprehensive Channel Modifications

Channel modification plans provide flood control protection by reducing the friction losses of the existing creek (by channel lining or clearing), by straightening and realigning the creek, or by creating a larger conveyance area. These measures are incorporated into channel modification alternatives to vary the extent as technical and economic feasibility analyses dictate. Channel modification results in improving the flood carrying capacity of the given creek thus reducing its flood damage potential.

The existing condition's hydraulics were carefully evaluated to determine the probable size and the extent of erosion protection (type of lining) which may be most cost effective while maintaining a quality design. In general, grass-lined channel plans were determined to be a more viable flood control alternative than concrete-lined channel plans due to the availability of land and minimization of environmental impacts. Concrete-lined channel plans would be more costly

to construct, cause significant environmental damage to the aquatic and terrestrial resources of Little Fossil Creek, and require more extensive and costly mitigation measures. In addition, one-sided, alternating bank excavation was incorporated into the design where possible to minimize adverse environmental impacts of the design.

The design was developed in three cumulative increments. All designs begin approximately 1,200 feet downstream of the Railtran Bridge (CRIP Railroad Bridge). Increment A extended up to within 700 feet of Thomas Road. Increment B extends upward to a point about 1,000 feet upstream of Thomas Road. Finally, Increment C proceeds upstream through the Midway Road Bridge, where it transitions back to the existing channel.

The initial bottom width selected for analysis was 90 feet. The actual bottom width and side slopes vary from reach to reach, depending on a variety of factors (available right-of-way, grassed or concrete, etc.). Full details of this plan can be found in Appendix B.

The first cost of this channel improvement alternative is $9.4 million, resulting in an annual cost of $711,000, and total benefits of $1.86 million. This results in a B/C ratio equal to 2.63, and net benefits of approximately $1.15 million, making this alternative even more economically attractive than the previous Carson Street/Airport Freeway Bridge Complex alternative.

Environmental Considerations. A Planning Aid Letter dated August 1987 from the U.S. Fish and Wildlife Service (USFWS) states "a preliminary assessment of the riparian area between Haltom Road and Walthall Street indicates that the habitat is a Category 2 resource, which is of high value for evaluation species and is becoming scarce in the ecoregion. The mitigation goal for Resource Category 2 is no net loss of in-kind habitat value. More recent coordination with the USFWS has indicated that the remaining reach of Little Fossil Creek to its confluence with Big Fossil Creek is also now a Category 2 resource. According to Fish and Wildlife Service Mitigation Policy (FWM 069 dated 24 February 1993), "the Fish and Wildlife Service will recommend ways to avoid or minimize losses. If natural resource losses are likely to occur, the Fish and Wildlife Service will recommend ways to immediately rectify them or reduce them over time. If losses remain likely to occur, the Fish and Wildlife Service will recommend that those losses be compensated by replacement of habitat value so that the total loss of habitat value will be eliminated."

It can be anticipated that any plan that involves channelization would adversely impact the terrestrial and aquatic resources of the Little Fossil Creek ecosystem. It will, therefore, be required that any impacts to the natural resources associated with the construction of a flood damage reduction project along Little Fossil Creek be mitigated. Continued coordination between the Corps and the USFWS will assure that all requirements are addressed. A Final Coordination Act Report will also be provided by the USFWS upon selection of the Recommended Plan.

Any proposed channel modification project must be reviewed for compliance with Section 401 and 404 of the Clean Water Act, and Section 10 of the Rivers and Harbors Act of 1899. Under Section 404, the Corps regulates the discharge of dredged and fill material materials into waters of the United States, including wetlands. Since the project would involve channelization, waters of the United States would be impacted and thus would require a 404(b)(1) analysis and a for compliance. Section 401 is certification that the proposed project would comply with state water quality standards. If a channel modification was selected as the recommended plan for Little Fossil Creek, it would be considered a Tier II project as detailed in the "Memorandum of Agreement Between the U.S. Army Corps of Engineers and the TNRCC. A Joint Public Notice for this project between the Corps and the TNRCC to inform the public and governmental agencies would be used to initiate a 30-day comment period for the TNRCC certification. This public review period would be the same one used for NEPA compliance.

OPTIMIZATION OF THE CHANNEL MODIFICATION ALTERNATIVE

As a result of the detailed investigations, three additional channel plans were evaluated in order to determine the optimal channel size from an economic standpoint. The additional selected sizes were 45 feet, 60 feet, and 75 feet. An attempt was made to capture all economic costs associated with implementation of these alternatives, including operation and maintenance and environmental mitigation requirements, if any.

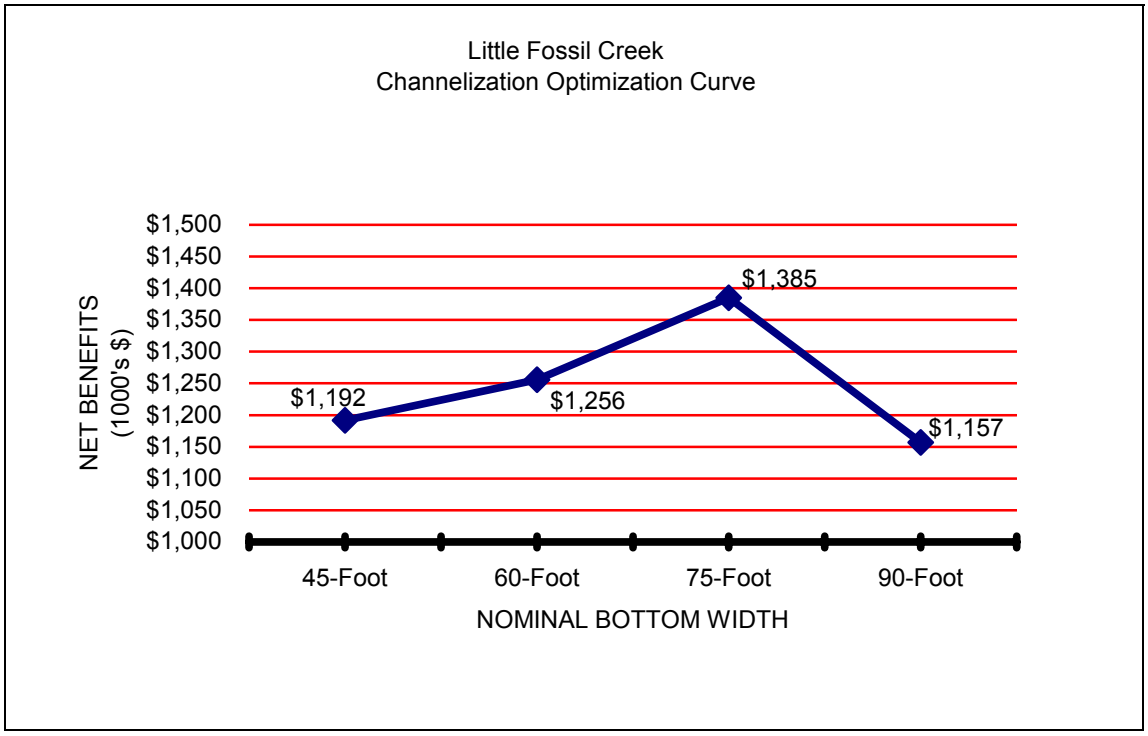
Full design details of these plans can be found in Appendix B, Hydraulics. Table 7 below provides an economic summary of the various channel sizes that were evaluated. Also shown for comparison purpose is the Carson Street/Airport Freeway Bridge complex alternative. The benefit-cost ratios for the channel modifications ranged from 2.63 to 4.2.

Of highest importance for determining the National Economic Plan from an economic perspective is the amount of net benefits attributable to the plan. The net benefits for each channel plan was plotted versus the bottom width, and the results are shown in Figure 4. The plan with a bottom width of 75 feet has the highest net benefits, which is estimated to be $1.39 million annually.

Table 7
Initial Economic Analysis of Structural Channel Plans
(based on May 2000 prices and level of development)
(1,000's of $'s)

	90-Foot	75-Foot	60-Foot	45-Foot	Carson Bridge
Investment					
Estimated First Cost	$9,437	$5,575	$5,231	$4,692	$3,456
Annual Interest Rate	0.0663	0.0663	0.0663	0.0663	0.0663
Project Life (Years)	50	50	50	50	50
Construction Period (Months)	19	19	15	15	12
Investment Cost	$9,933	$5,868	$5,446	$4,885	$3,569
Annual Charges					
Interest	$658	$389	$361	$324	$236
Amortization	$28	$16	$15	$14	$10
Operation/Maintenance ($/Year)	$25	$25	$30	$35	$25
Replacements	$0	$0	$0	$0	$0
Total Annual Charges	**$711**	**$430**	**$406**	**$372**	**$271**
Annual Benefits					
Inundation Reduction	$1,868	$1,815	$1,662	$1,564	$524
Net Benefits	**$1,157**	**$1,385**	**$1,256**	**$1,192**	**$253**
Benefit-To-Cost Ratio	**2.63**	**4.2**	**4.1**	**4.2**	**1.9**

Figure 4



SUMMARY OF ALTERNATIVE PLANS INVESTIGATED

Although one non-structural alternative was economically feasible, it was eliminated from detailed consideration because channel modification alternatives provided greater comprehensive flood protection and higher net benefits to more structures along Little Fossil Creek.

Of the structural and nonstructural flood damage plans considered during this study, channel modification of Little Fossil Creek emerged from these alternative analyses as the most effective and efficient flood damage reduction alternative. One-sided construction was used where possible to keep environmental impacts to a minimum. Further, the channel plan with an average bottom width of 75 feet provided the highest net economic benefits, and will be considered for designation as the NED plan. A complete economic summary of the plans considered in the detailed investigations is shown in Table 8.

Table 8
Summarized Economic Evaluation of All Investigated Plans
(in $1,000's of dollars)
(May 2000 prices and level of development, 6.625% interest)

	Residual	*Flood Reduction Benefits*	*Insurance Subsidy Benefits*	*Total Benefits*	*Estimated 1st Cost*	*Annual Costs*	*Net Benefits*	*BCR*
Structural Plans								
90-Foot Channel	$ 293	$ 1,798	$ 70	$ 1,868	$ 9,437	$ 711	**$ 1,157**	**2.6**
75-Foot Channel	$ 376	$ 1,764	$ 51	$ 1,815	$ 5,575	$ 430	**$ 1,385**	**4.2**
60-Foot Channel	$ 467	$ 1,624	$ 38	$ 1,662	$ 5,231	$ 406	**$ 1,256**	**4.1**
45-Foot Channel	$ 559	$ 1,532	$ 33	$ 1,564	$ 4,692	$ 372	**$ 1,192**	**4.2**
Carson Bridge	$ 1,573	$ 518	$ 6	$ 524	$ 3,456	$ 271	**$ 253**	**1.9**
Nonstructural Plans								
5-Yr Buyout	$ 2,084	$ 7		$ 7	$ 70	$ 5	**$ 2**	**1.4**
10-Yr Buyout	$ 1,507	$ 584	$ 6.3	$ 590	$ 17,780	$1,352	**($769)**	**0.4**
Combination Plan								
Buyout w/Carson Bridge	$ 990	$ 1,101	$ 6.3	$ 1,107	$ 21,236	$1,549	**($442)**	**0.7**

IDENTIFICATION OF THE NED PLAN

The identification of the NED plan depends upon careful consideration of engineering, economic, social, and environmental factors. The following paragraph outlines the process of identifying the NED plan.

Guidelines for selection of a plan for implementation, as provided by the Water Resources Council's "Principles and Guidelines for Planning Water and Related land Resources Implementation Studies," state that a plan recommending Federal action is to be the alternative plan with the greatest net national economic development (NED) benefits, i.e. the NED plan, unless the Assistant Secretary of Army (Civil Works) grants an exception. Current Policy allows such exceptions for locally preferred plans. Such locally preferred plans must comply with Federal rules and statutes, most important of which, the project benefits must exceed the project costs. Federal participation in a locally preferred plan is limited to the extent which would have

been required by the NED plan. Consequently, the local sponsor is responsible for all additional costs of the larger plan above and beyond the costs of the Federal NED plan.

After consideration of all factors, the channel modification plan with an average bottom width of 75 feet was selected as the NED plan.

SELECTION OF THE RECOMMENDED PLAN

The City of Haltom City indicated during the early stages of the feasibility studies that their planning objectives may vary from the Federal objectives. Specifically, the City placed great emphasis on the planning objective pertaining to complete protection from all floods equal to or less than a 100-year storm event. If the NED Plan did not provide this level of protection at a minimum, then the City was prepared to "buy-up" to a plan that met this objective, assuming that the larger plan was found to be economically feasible and in the Federal Interest.

After completion of the channel optimization process, the NED plan was evaluated to determine if it met the City's stated planning objective. It was determined that the NED plan did, indeed, contain the 100-year storm event, and upon implementation of this project and successful revision of the FEMA Flood Insurance Rate Maps, residents and businesses located within the study area would no longer be required to purchase flood insurance.

Based on the findings cited above the City of Haltom City concurred with the Corps of Engineers, and the NED plan was selected as the recommended plan. This plan will be developed in more detail for implementation purposes.

THE RECOMMENDED PLAN

DETAILED DESCRIPTION

The Recommended Plan, or NED Plan, consists of a combination grass- and concrete-lined trapezoidal channel, which begins approximately 1,100 feet downstream of the Railtran Bridge and continues upstream, ending just downstream of the Belknap Street Bridge. The total project has an aggregate length of 7,350 feet, which includes channel widening and deepening with some erosion control features. This plan features channel widening to a 75-foot average bottom width with alternating, one-sided side slope cuts were possible. A comparison table between the existing and improved condition is attached at the end of Appendix B in Table B-3.

The channel improvements begin approximately 1,100 feet downstream of the Railtran Bridge. The channel is grass-lined with a 75-foot bottom width and 3.5:1 side slope cuts on the left bank. This configuration continues until downstream of the Railtran Bridge where the channel transitions to a wider 90-foot bottom width with 3.5:1 side slopes. At the Railtran Bridge, both the downstream and upstream inverts are 488.7. Once through the bridge, the channel bottom width remains at 90 feet, but the 3.5:1 side slope cuts switch to the right bank for 1,080 feet. At this point, a concrete lined channel transitions the creek to a 45-foot bottom width, concrete-lined channel with 1.5:1 side slopes through the South Access Road, Carson Street, and North Access Road bridges. This was the largest opening allowed under the bridge without modifications to the existing bridge structure. This channel configuration remains constant for approximately 1,750 feet where the concrete channel transitions back to a 75-foot bottom width, grass-lined channel with 3.5:1 side slopes.

The now grass-lined channel continues 725 feet upstream to where the side slopes transition to 2.5:1 through the Thomas Road Bridge, then transition back to 3.5:1 upstream of Thomas Road for 960 feet. The downstream and upstream invert elevations at Thomas Road are 497.5 and 497.6, respectfully. As described above, the existing channel both upstream and downstream of the Thomas Road Bridge is perched, which means that the channel banks are higher than the adjacent overbank elevations. Once overflow occurs, a vast area of developed land in the overbank area is inundated. To protect against this, an earthen berm of no more than 2-feet in height is included in the design on the east bank of the creek. This should not affect drainage since the natural slope is away from the creek.

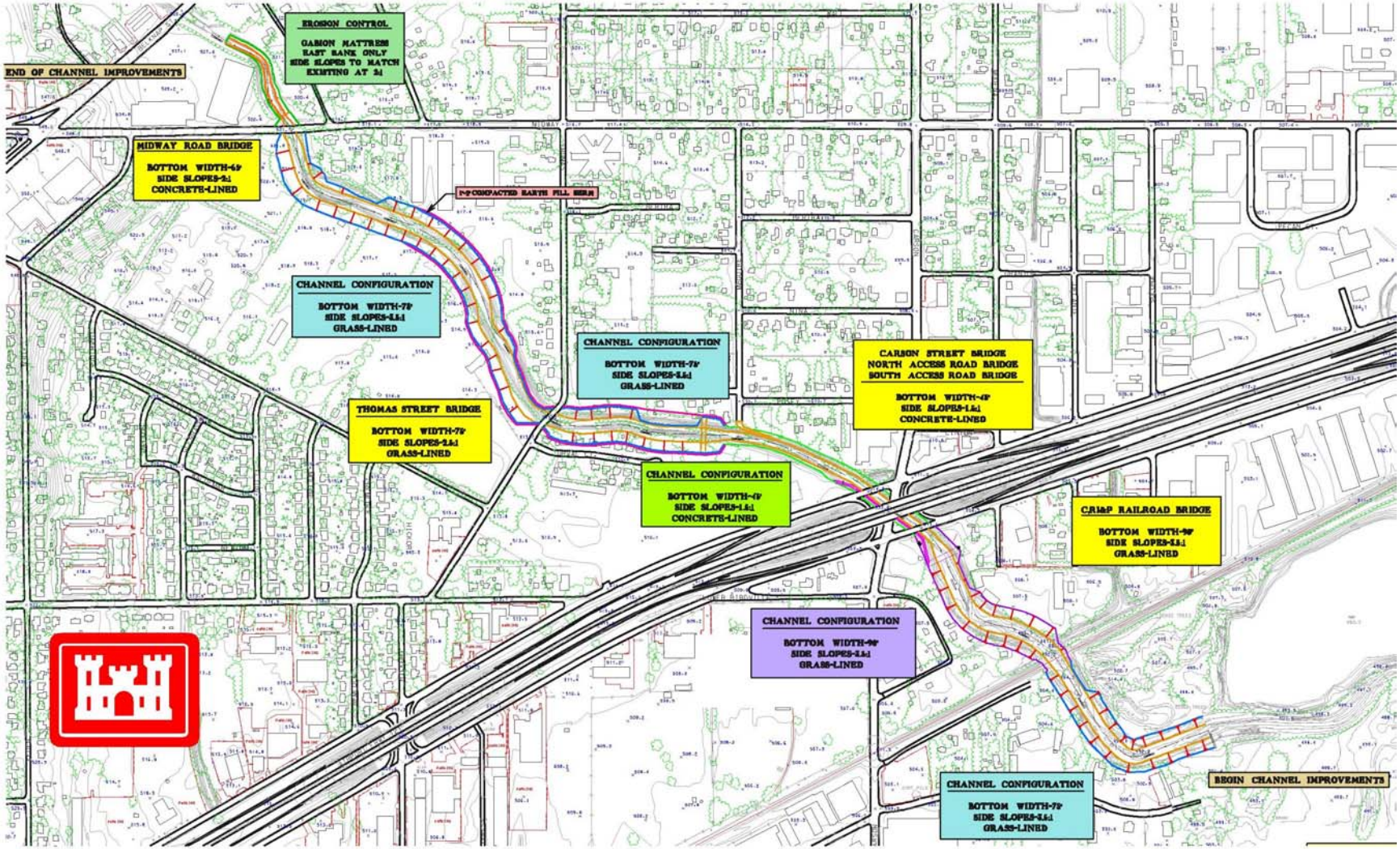
Continuing upstream, the 75-foot bottom width, grass-lined channel with 3.5:1 side slopes continues 1,140 feet to the Midway Road Bridge transition which reduces the bottom width to 65 feet and steepens the side slopes to 2:1 through the bridge. The downstream and upstream invert elevations of the Midway Road Bridge are both 501 feet. Upstream of Midway Road, the creek experiences high velocities due to previous channel work with minimal erosion control measures. The reach has become highly erosive, which will only increase as a result of the channel improvements proposed in this study. Environmentally, this portion of the creek provides a good corridor of quality natural habitat through an otherwise highly modified environment. Dominant tree species exist along the creek as well as abundant bird fauna with tree shade throughout. Residents along this portion of the creek have expressed concern that channelization would considerably affect the pleasing environmental aesthetics. On the contrary, if this reach was left in its existing condition with no erosion control method in place, the now even higher velocities resulting from the downstream improvements and larger bridge opening at Midway Road, would degrade the stream bed and severely cut the east bank slopes to a degree where bordering residents would eventually lose a significant portion of their property. In order to achieve the primary goals set early in the study, an array of alternatives were analyzed in this reach. The final proposed design would be one that provides the necessary erosion protection while minimizing the actual modifications through this portion of the creek. In doing so, the erosion control would be limited to match the existing channel configuration and alignment. By limiting the modifications to match the existing creek configuration, the 100-year level of

protection is not achieved between Midway and Belknap. Although the flow is out of the channel banks, the improvements downstream of the Midway Road Bridge are sufficient enough to lower the tailwater at the bridge to where the water ponds behind it but does not split off to the east. No flood inducements will occur. Excavation to the east bank will be limited to side slope shaping to 2:1 for placing a gabion mattress. The west bank of the creek will remain in its natural state except at the toe of the new channel invert where a gabion basket will be placed to protect the exposed toe of the creek. The channel slope from Midway to Belknap drops approximately 6 feet, which will be gradually sloped with various grade change transitions to match the existing inverts. The channel bottom will be cleaned out of all debris and if necessary, lined with gabion mattress to prevent erosion or scour.

The Recommended Plan would result in adverse impacts to terrestrial and aquatic resources that could not be avoided. A plan to mitigate those adverse effects has been developed jointly between the Corps, the U.S. Fish and Wildlife Service, and the Texas Natural Resource Conservation Commission. The mitigation area is located at the southern terminus of the project area, between the east bank of Little Fossil Creek and the Trinity Waste Landfill, south of the Rail Tran railroad line. It is comprised of 11.04 acres of forested habitat, 19.89 acres of open water, and 33.11 acres of scrub/old field habitat. The plan involves mast producing hardwoods and associated shrubs at appropriate densities (80 trees and 30 – 40 shrubs per acre). An additional feature of the mitigation area would be to use clean excavated overburden from the project to create 10 acres of shallow water wetland habitat in the abandoned gravel quarry. Mitigation features would be implemented concurrently with construction of the project features.

Losses of stream aquatic habitat will be mitigated primarily through restoration of pool/riffle complexes. The upper reach between Belknap and Midway will be restored to the existing condition of one meander wavelength that consists of 3 riffles, each occurring at the inflection points, and 2 pooled areas. The reach between Midway and the upstream end of the concrete channel, approximately 3,000 feet in length, will be designed to restore 6 meanders that will include 12 riffles and 12 pools. Finally, the southernmost reach from Carson to the downstream limit of the project will contain 1 meander including 3 riffles and 3 pools. Other instream techniques will also be applied, where feasible, which include boulder clusters, rock check dams, and natural channel constrictors and deflectors.

FIGURE 5. THE RECOMMENDED PLAN



HYDROLOGIC AND HYDRAULIC IMPACTS

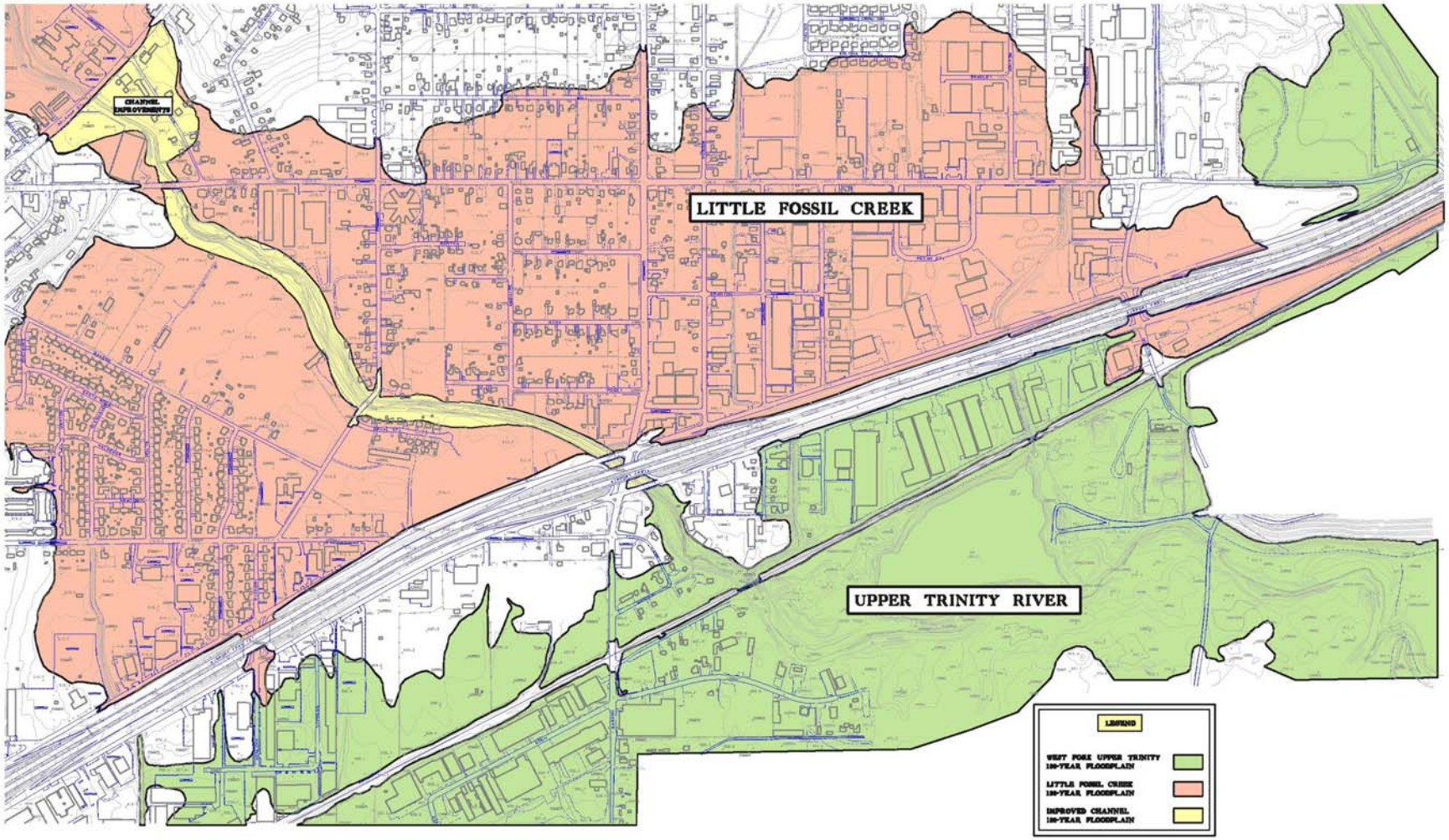
Implementation of the Recommended Plan serves to decrease the water surface profiles for any given frequency throughout the project reach. As a result, the floodplain areas being inundated are substantially less, as can be seen in Figure 6.

Channel velocities for given flows are generally increased. The increased velocities have been taken into account during the design of the project in order to assure that no potentially erosive areas are left unprotected. Special design efforts were undertaken for the upstream end of the project, where a substantial amount of gabion protection was specified. This is discussed in greater detail in Appendix B – Hydraulic Analysis.

Implementation of the Recommended Plan will also result in increases in downstream discharges immediately below the Airport Freeway Bridge Complex. A small fraction of the increase may be attributable to reduced valley storage and less hydrograph attenuation. However, the majority of the difference is the result of elimination of the split flow area to the east. During passage of the 100-year storm event under existing conditions, it is estimated that as much as 8,785 cubic feet per second (cfs) of the total 100-year peak discharge of 15,000 cfs was diverted toward the east in an overland flow fashion. Construction of the Recommended plan will completely eliminate this diversion, and the total discharge will now pass through the Carson Street/Airport Freeway Bridge Complex. As a result, the area will be subject to slightly increased velocities and water surfaces elevations for flood events occurring on Little Fossil Creek.

From an elevation versus flood frequency standpoint, any adverse downstream impacts will be essentially negligible. This is due to the backwater effects associated with the West Fork Trinity River. Figure 6 provides a delineation that clearly delineates the 100-year flood plain area controlled by the West Fork. Within this area, changes to the Little Fossil Creek water surface elevations for frequencies above a 50-year event have little bearing on any actual stage versus frequency relationships.

FIGURE 6 – 100 YR FLOOD PLAIN AREA



DISPOSAL SITE

The City of Haltom City has established locations for disposal of excess excavated overburden and waste material. These locations are shown on Sequence 1A of Appendix I. Materials slated for disposal consist of approximately 270,000 cubic yards of overburden material, 1400 cubic yards of slope concrete paving from bridge abutments, and debris material from brush and tree clearing. Disposal of overburden material can be done within project limits at an old gravel pit located just downstream of the beginning of the project. This area will be used for mitigation in that a shallow wetland area will be developed. Concrete and tree debris will have to be removed to off site disposal sites located about two miles from the project site. Concrete rubble shall be placed such that the city can reuse the material as riprap. Excess tree or brush debris shall be mulched at the disposal site.

Based on the recommendation by the U.S. Fish and Wildlife Service, and with concurrence of the City of Haltom City, some debris material from brush and tree clearing will be used within the proposed mitigation area to construct habitat features from brush piles, stumps, logs, and large boulders. The placement rate would be approximately one structure per acre. The plan will be more fully defined during the plans and specifications.

RELOCATIONS

BRIDGES

The existing channel crosses several roads within the project area. Beginning on the downstream end, the channel crosses the eastbound service road for State Highway 121, Carson Street, the State Highway 121 overpass, and the westbound service road for State Highway 121, Thomas Road, and Midway Road. Currently the Texas Department of Transportation (TXDOT) is designing a new bridge at Midway Road, due to deficiencies in the existing bridge. It will be replaced prior to construction of this project. The new bridge configuration for Midway Road will be 138’ long, 59’ wide and has a 27-degree skew. The bridge will be approximately 15 feet high and have 2 horizontal to 1 vertical paved slopes. After the channel modification and construction of the new bridge the actual hydraulic depth will be approximately 19 feet.

The new bridge at Midway Road will accommodate the proposed channel improvements. The channel configuration under this bridge will be such that transition to the improved conditions will be minimal. The other bridges that cross the creek will not be altered. Transition of the existing conditions to the improved channel will be such that no flow levels will be impeded. The bridges are discussed in detail in Civil Appendix I – Civil Design.

RAILROADS

A Railtran Bridge crosses the existing channel on the downstream end of the project, at design station 57+60. The bridge is 186’ long, 14’ wide, and has no skewed piers. The bridge is approximately 15’ high and has ballast covered slopes. No improvements to the Railtran Bridge will be required; however, the transition from the existing conditions to the improved channel will be such that no flow levels will be impeded

UTILITIES

There are several utility lines within the project limit improvements that will be impacted.

Water

The existing 8” water line on the eastbound service road for State Highway 121 will need to be relocated by lowering its profiles.

Storm Drains

Three 72” pipes and one 54” pipe currently discharge into the creek under State Highway 121. These current storm drain outlets are located on Right-of-Way owned by the State of Texas. The outlets will be incorporated into the new, enlarged channel during construction.

Natural Gas

The existing 4” gas line on the eastbound service road to State Highway 121 will need to be relocated by lowering its profiles.

Fiber Optic

The existing fiber optic lines and structure on the south edge of the railroad right of way will be required to relocate below the improved channel grade.

Telephone

The existing 50 pair buried telephone cable on the south side of the railroad right of way will be require to relocate below the improved channel grade.

REAL ESTATE

The project area would include portions of property adjacent to the proposed channel improvements along Little Fossil Creek. The acquisition requirements include 26 acres of permanent channel easement, of which 12 acres are already owned by the City, and 1.5 acres of temporary work area easement. In addition, approximately 95 acres are required for mitigation of adverse impacts to wildlife habitat, and 4.4 acres for access to the proposed recreation features. Fee value within and outside the existing creek banks have been estimated at $395,550. Temporary work area easement values were estimated to cost $6,823. An estimated 111 ownerships would be involved in the proposed acquisitions. Most of the properties are residential although some are commercial lots and city-owned park lands. The total cost of real estate acquisitions and administrative costs are estimated to be $3,420,700. The real estate costs are based on a gross appraisal prepared by the Fort Worth District staff dated 1 Feb 2001, which contained a base cost of $3,390,250, then escalated to June 2001 price levels. A detailed discussion of the real estate requirements for this project is contained in Appendix F - Real Estate.

Implementation of the Recommended Plan will cause the displacement of seven residences and one horse barn. All of these residences are located along Orval Court on the west side of Little Fossil Creek, just downstream of Thomas Road. Replacement housing is readily available in the general vicinity. Total estimated cost for acquisition and relocation assistance is approximately $445,000.

OPERATION AND MAINTENANCE

The major items of operation and maintenance of the completed project include periodic mowing of vegetative growth throughout the terrace and the excavated side slope, repair from erosion damage which may occur, and other necessary maintenance such as post-flood cleanup and trash pickup. Periodic mowing (at least twice per year) should take place at specific times to

minimize disturbance to nesting wildlife and food production of plants. The annual cost of operation and maintenance, repair, replacement and rehabilitation of the Recommended Plan, including the mitigation area, is estimated to be $25,000.

RECREATION

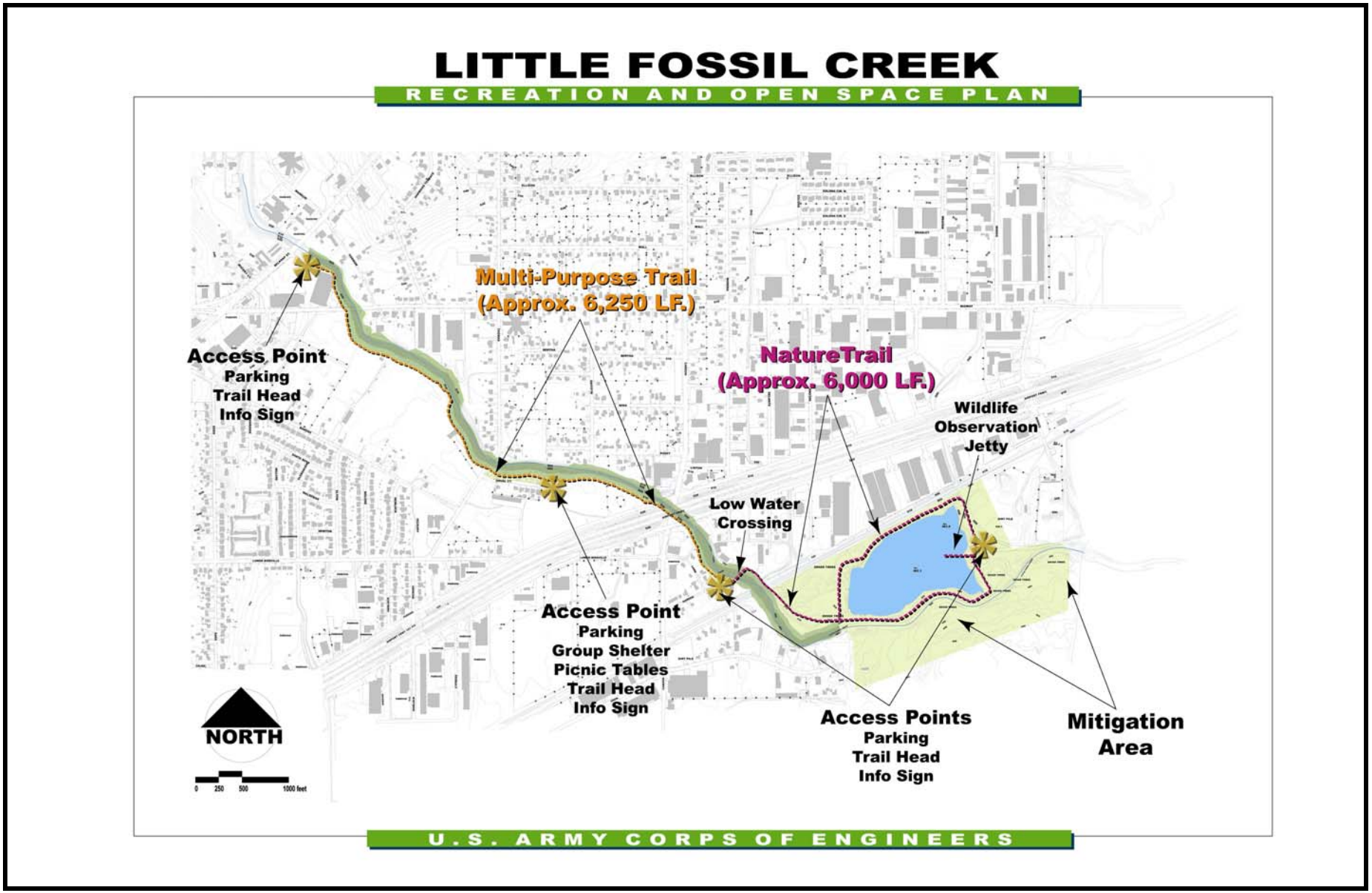
Recreation needs are fully addressed in Appendix J. The Recommended Plan proposes a multi-purpose trail designed to provide access for hiking, jogging, bicycling and nature study (Figure 7). The plan consists of approximately 6,250 linear feet of ten-foot wide concrete multi-use trail along the west side of Little Fossil Creek, connected by a low-water crossing to an additional 6,000 linear feet of six to eight-foot un-surfaced nature trail circling the small lake in the Mitigation Area. An observation jetty will be created in the Mitigation Area, using spoil material from the project. The trail will also provide the city with access for maintenance of the channel.

The trail system will be easily accessible from adjacent neighborhoods. Residents who do not live nearby will be able to drive and park their vehicles at one of the four access areas. A major access area will be located along Orval Court, where a picnic shelter and 11 picnic sites are planned. Additional access points will be located near Belknap Street, Garden Street, and off Minnis Drive near the Mitigation Area. Each access area will have a parking lot, drinking fountain, park benches, informational signage, and security lighting.

During the development of the plans and specifications, particular attention will be given to construction of the trail and associated facilities within the mitigation area, including a public access point and parking lot. Emphasis will be placed on construction methods that will result in the minimization of impacts.

This trail will provide an important portion of the proposed greenbelt system that Haltom City has envisioned along the Little Fossil Creek corridor, and may eventually be extended to link Haltom City with the regional Trinity Trails system. The recreational amenities have an incremental benefit-to-cost ratio of 10.0 and improve the overall b/c ratio of the project.

FIGURE 7. RECREATION AND OPEN SPACE PLAN



ENVIRONMENTAL AND CULTURAL IMPACTS OF THE RECOMMENDED PLAN

TERRESTRIAL AND AQUATIC RESOURCES

Terrestrial Resources

Construction of the recommended plan would adversely impact plant and animal terrestrial resources inhabiting the approximately 1.85 acres of old field habitat and 17.86 acres of forested riparian habitat along Little Fossil Creek.

Predominate terrestrial habitat types that were identified along Little Fossil Creek are “Old Field” and “Riparian Forest”. The old fields are open areas primarily devoid of any woody vegetation and contain mostly cultivated grasses such as Coastal Bermuda. These areas may also contain some larger herbaceous species like sunflowers or ragweed. Riparian Forests are the highly vegetated corridors adjacent to Little Fossil Creek. The vegetation within the riparian corridor of Little Fossil Creek is mostly composed of Pecan, Bur Oak, and Red Oak. The other trees that were observed in the study area included Cottonwood, Cedar Elm, Green Ash, Black Willow, Box Elder, Hackberry, Red Mulberry, Fruitless Mulberry, Mesquite, Bois d’ Arc, and Chinaberry. The under story and open space vegetation that was observed around Little Fossil Creek during this survey included: Ragweed, Buttonbush, Indian Cherry, Coralberry, Sideoats Grama, Virginia Creeper, Blackberry, and Greenbriar. Some of the more obvious forms of terrestrial habitat around Little Fossil Creek are vertical and horizontal snags, brush piles, hollow trees, and burrows. Little Fossil Creek is mostly a perennial stream, except during periods of low rainfall or extended drought. The aquatic habitat within Little Fossil Creek is abundant and diverse. The creek contains several riffle/run/pool complexes of various depths and gravel consistency, undercut banks, rock shelf outcrops, root wads, dead fallen trees and branches.

Adverse impacts to terrestrial resources would occur through the elimination of critical wildlife habitat essential to complete life cycle requirements and by direct mortality. The abundance and diversity of wildlife found in an area is the result of the habitat available for nesting, foraging, shelter, reproduction and rearing of young. Removal of the old-field, open space, and riparian habitat would result in a reduction in the number and diversity of terrestrial wildlife species present. The reduction in the abundance and diversity of habitat resulting from implementation of this alternative would generate conditions unable to support some plant and wildlife species. With the removal of habitat, the terrestrial plant species composition along Little Fossil Creek would change to one more characteristic of a disturbed environment, that are dominated by a few species that could tolerate the new environmental conditions. Of the alternatives evaluated for the Little Fossil Creek project, the recommended plan avoided the greatest amount of terrestrial habitat consistent with providing the necessary level of flood protection.

Aquatic Resources

Without Aquatic mitigation and minimization of impacts, it is predicted that the following impacts would occur to the Aquatic Resources: (1) Construction of the recommended plan would adversely impact approximately 7,500 linear feet (4.04 acres) of non-wetland jurisdictional waters of the United States; (2) Adverse impacts to the aquatic resources of Little Fossil Creek would occur through generation of poor water quality, removal of aquatic habitat, and direct mortality; (3) Implementation of this alternative would create water quality and habitat conditions that would be incapable of supporting many sensitive aquatic plants, invertebrates and vertebrates (4) Eventually, the aquatic species architecture in Little Fossil Creek would resemble that of a disturbed environment, with low species diversity and little aquatic habitat; and (5) Aquatic species capable of surviving in a disturbed environment would eventually dominate the Little Fossil Creek ecosystem.

LAND USE

In accordance with Section 202(c) of the Water Resources Development Act of 1996, within one year of implementation of the proposed project, Haltom City would be required to submit a Flood Plain Management Plan (FPMP). Measures in the FPMP would include restrictions on any business or residential development in the floodplain of Little Fossil Creek. Under these restrictions, land use in the floodplain would not be further adversely impacted as a result of implementing the recommended plan.

WATER QUALITY

Implementation of this alternative would result in short- and long-term adverse impacts to the water quality of Little Fossil Creek. Short-term impacts would result from the movement of construction vehicles associated with excavation and grading activities in and around the Little Fossil Creek channel. These activities would generate suspended sediments in the water column and increase turbidity levels. Suspended sediments would shade and silt over oxygen producing phytoplankton and aquatic plants and suppress water dissolved oxygen levels. Long-term impacts to water quality would result from removal of vegetation in the riparian corridor surrounding Little Fossil Creek. Removal of the Little Fossil Creek tree canopy would reduce the amount of water shading and would cause increases in water temperatures. At a higher temperature, water is less capable of holding dissolved oxygen. Consequently, annual average dissolved oxygen concentrations in Little Fossil Creek would be lower because of higher water temperatures. Removal of the other components of the Little Fossil Creek riparian corridor would adversely compromise the ability of the riparian system to contribute organic nutrients to the stream ecosystem and adversely impact the riparian corridor's ability to filter out nutrients or noxious chemicals from the watershed. Implementation of a restrictive FPMP would moderate some of the adverse impacts resulting from the loss of the riparian corridor by limiting floodplain development and associated increases in the concentrations of nutrients or noxious chemicals that would enter the Little Fossil Creek ecosystem.

Adverse impacts to water quality would be minimized through the development and implementation of a National Pollution and Discharge Elimination System (NPDES) Storm Water Pollution Prevention Plan (SWPPP) that require provisions for corrective and implementable measures to prevent pollutants from entering Little Fossil Creek during a storm event that would occur during and after construction activities. This requirement is for project sites greater than 5 acres, including all temporary access roads, trailer sites, storage areas, and any other disturbed area associated with the project. The contractor would be required to complete a Notice of Intent (NOI) for Storm Water Discharges as required for an NPDES General Permit administered by the Environmental Protection Agency (EPA). The Contractor would also develop a detailed SWPPP within the guidelines of the COE's basic SWPPP and will provide drawings to accompany the SWPPP showing the locations of all stormwater controls. Stormwater controls entail both methods for temporary and permanent stabilization.

Temporary Measures To Minimize Short-Terms Impacts to Water Quality

Temporary stabilization activities would occur for all unpaved, graded and disturbed portions of the site when construction activities cease for 21 days or more and there is no requirement for permanent turfing. Temporary stabilization include structural and nonstructural measures. A nonstructural method for temporary stabilization would be to till the soil around Little Fossil Creek to a depth of four inches, spread native prairie hay such as broomsedge, bluestem, little bluestem, big bluestem, switchgrass, and Indian grass, at a rate of 4000 pounds per acre, and anchor the mulch into place using a mulch anchoring machine equivalent to a disk harrow with cupped disks removed and replaced with straight rolling coulters spaced not more than eight inches apart. Structural stormwater controls would be used during temporary stabilization to prevent soil erosion where construction produces the potential for significant erosion damage,

particularly where there is significant slope and at the boundaries of the project's unpaved and disturbed land. Some of the typical temporary structural stormwater controls that would be used to minimize sediment runoff include silt fences, staked hay bales, diversion dikes, excavated sediment traps, pipe slope drains, rock berm or check dams, log check dams, rock check dam, and sand bag berms. In feasibility, the level of detail of study detail makes it impractical to state specifically what measures would be used and where the stormwater controls would be placed, the following are the specific conditions under which each measure could be utilized:

Silt Fence – Silt fences shall be used for drainage areas of 1 acre or less with velocities of 0.5 FPS or less. The silt fences would not be constructed in tributaries or swales that lead into Little Fossil Creek. The silt fences would be used primarily for perimeter control of overland flow to prevent sheet and rill erosion. Sediment would be removed from the silt fence when it accumulates to one-third the height of the fence. The silt fences would be securely fastened to each support post or to the backing, which is in turn attached to a fence post. See Figure 7a.

Staked Hay Bales – Staked hay bales would be used for drainage areas of 1 acre or less with velocities of 0.5 FPS. The bales would not be used in tributaries or swales that lead into Little Fossil Creek. The hay bales would be used primarily for perimeter control of overland flow to prevent sheet and rill erosion. The hay bales would be used where the effectiveness is required for less than 3 months, or the bales would be replaced every three months. Hay bales would be placed end to end with no caps between the bales. The accumulated sediment would be removed and disposed when it reaches a depth of 6". See Figure 7b.

Diversion Dikes – Diversion dikes would be used to divert storm flows of 1 foot in depth or less, from Little Fossil Creek. The side slopes of the diversion dikes would be 3:1 or flatter and the minimum width of the embankment at the crown would be 2 feet. Dike height would be a minimum of one foot greater than the flow depth for the 10-year event. Diversion dikes would be placed parallel to existing contours for perimeter control by diverting run-on water away from the disturbed area. See Figure 7c.

Excavated Sediment Trap - An excavated sediment trap would be used in small drainage areas around Little Fossil Creek of less than 1 acre, where overflow capacity is needed and in areas of heavy flow, 0.5 CFS or greater. The drainage area would be fairly flat with slopes of 5% or less. Washed gravel (3-5 inches in diameter) would be used to a depth of at least 1 foot. The recommended volume of sediment trap is 35 cubic yard per acre disturbed. Sediment would be removed from the trap when it accumulates to half the height of the filler stone. Weep holes would be filled with grout prior to backfilling of storage. See Figure 7d.

Pipe Slope Drain – A pipe slope drain would be recommended for drainage areas around Little Fossil Creek up to 10 acres. The pipe inlet and outlet would be stabilized. A flared end section would be used at the entrance of the pipe and soil around the pipe fully compacted. The outlet would enter into a 12inch thick bed of riprap. Diversion dike height on the drain would be a minimum of one foot greater than the flow depth for the 10-year event. See Figure 7e.

Rock Berm or Check Dam – Check dams would be installed in steeply sloped swales or in swales sloping into Little Fossil Creek where adequate vegetation cannot be established (not streams). Open graded rock, 4-8 inches in diameter would be used in the check dams. The dams would be secured with a woven wire sheathing having maximum 1 inch opening and minimum wire diameter of 20 gauge. Check dams would be spaced so that the toe of the upstream dam is at the same elevation as the top of the downstream dam. Debris and sediment would be removed from behind the dam when it accumulates to one-third of the height of the berm. See Figure 7f.

Log Check Dam – Log check dams would be installed in steeply sloped swales, or in swales sloping into Little Fossil Creek where adequate vegetation cannot be established (not streams). The logs used would be from 6 to 8 inches in diameter. Log check dams would be spaced so

that the toe of the upstream dam is at the same elevation as the top of the downstream dam. Debris and sediment would be removed from behind the dam when it reaches a height of one half the original dam height. See Figure 7g.

Rock Check Dam – Rock check dams would be installed around Little Fossil Creek in drainage areas of 2 acres or less. Rock check dams would be constructed with 5 to 15 inch diameter stone. The maximum height of the rock check dam would be no greater than 3 feet and the center of the dam would be 6 inches lower than the outer edges. For added stability, the dam would be keyed into the surrounding soil approximately 6 inches deep. Filter cloth may be added under the stone to provide a stable foundation and facilitate removal of the dam. Rock check dams would be spaced so that the toe of the upstream dam is at the same elevation as the top of the downstream dam. Debris and sediment would be removed from behind the dam when it reaches a height of one half the original dam height. See Figure 7h.

Sand Bag Berm – Sand bag berms would be used around Little Fossil Creek, when the contributing drainage area is greater than 5 acres. The sand bags would be constructed from polyethylene, polyamide or cotton burlap woven fabric, have a minimum weight of four ounces per square yard, a mullen burst strength exceeding 300 PSI and ultraviolet stability exceeding 70 percent. Sand bags would be 24 to 30 inches in length, 16 to 18 inches in width and 6 to 8 inches in thickness. The sand bags would be filled with coarse grade sand, free from deterous material, and shall pass through a No 10 sieve. The minimum weight of the bag would no less than 40 lbs. See Figure 7i.

The construction contractor would be able to select from these temporary measures for sediment control according to the appropriate existing conditions. The final selection of controls would have to be approved by a Corps of Engineers Contracting Officer. Many of the stormwater controls are temporary and would be removed after final site stabilization is completed. Some of the temporary stormwater measures; however, would remain in place as permanent measures to control erosion, create additional wildlife habitat, and improve water quality.

Permanent Measures To Minimize Long-Terms Impacts to Water Quality

Permanent site stabilization would occur at the Little Fossil Creek project site when construction activities permanently cease. Several of the measures previously described for temporary stabilization would applicable for permanent stabilization. Of the methods previously described for temporary stabilization, those measures that utilize natural materials such as the log and rock check dams would remain in place permanently. The log and rock check dams would provide permanent stabilization in areas where there is high erosion potential. The stabilization and reduction of soil erosion that would occur in the bank areas where these measures have been installed would eventually allow riparian vegetation to become established, create additional wildlife habitat and provide water quality benefits by filtering runoff water that flows into Little Fossil Creek during storm events. In addition to the permanent stabilization measures previously identified, turfing work would be done from 1 April to 1 June. Live sod would be placed on all disturbed and unpaved areas. If available living sod containing native vegetation would be used. The areas to be sodded would be excavated to a sufficient depth so that the top of the sod when set in place would be about ½ inch below the surrounding soil at the outer edges of the solid sodded area. Sod would be immediately pressed firmly into contact with the sod bed by hand tamping. Screened soil of good quality would be used to fill all cracks. Sod would be watered and fertilized at an approved rate and for a duration necessary to ensure permanent survival. The native sod would serve habitat for the native wildlife species by providing food, cover, and nesting material. The sod would act as a filter to improve the water quality of Little Fossil Creek and runoff water during storm events.

Also a non-maintenance herbaceous riparian corridor would be maintained a minimum of 5 feet from the edge of the base flow channel. Non-woody native vegetation, such as sedges, grasses, and rushes, would be allowed to establish in the zone next to the base flow channel.

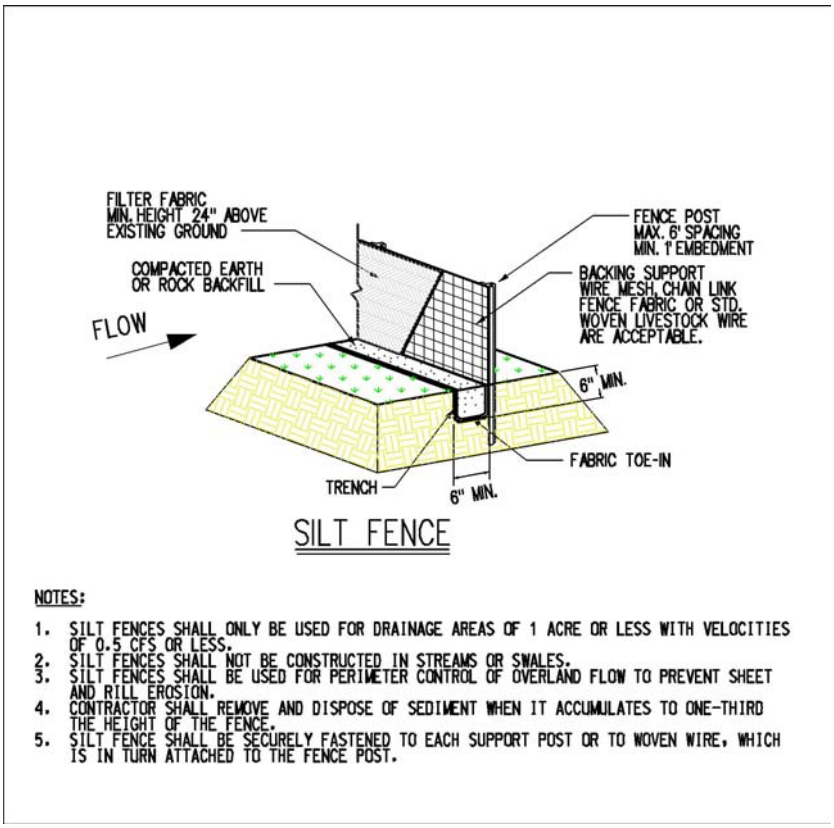


Figure 7a. An illustration of a silt fence stormwater control structure.

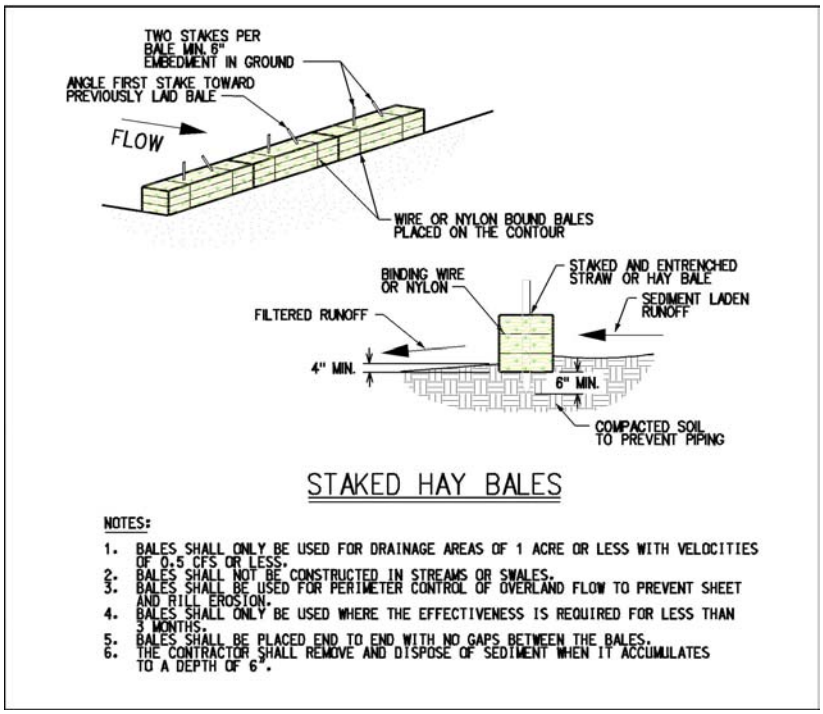


Figure 7b. An illustration of a staked hay bale stormwater control structure.

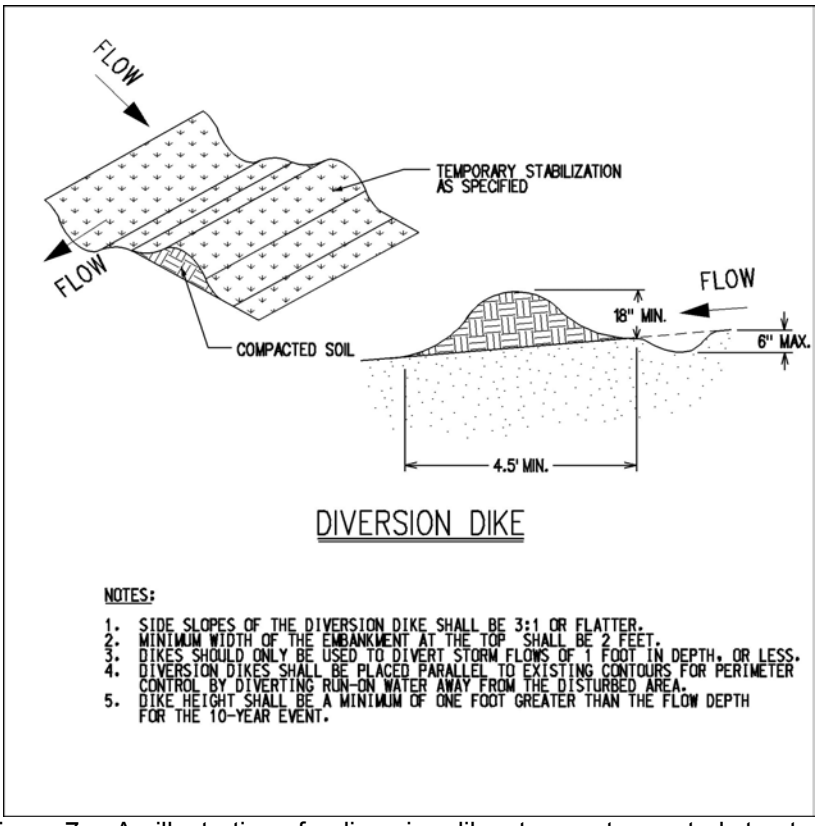


Figure 7c. An illustration of a diversion dike stormwater control structure

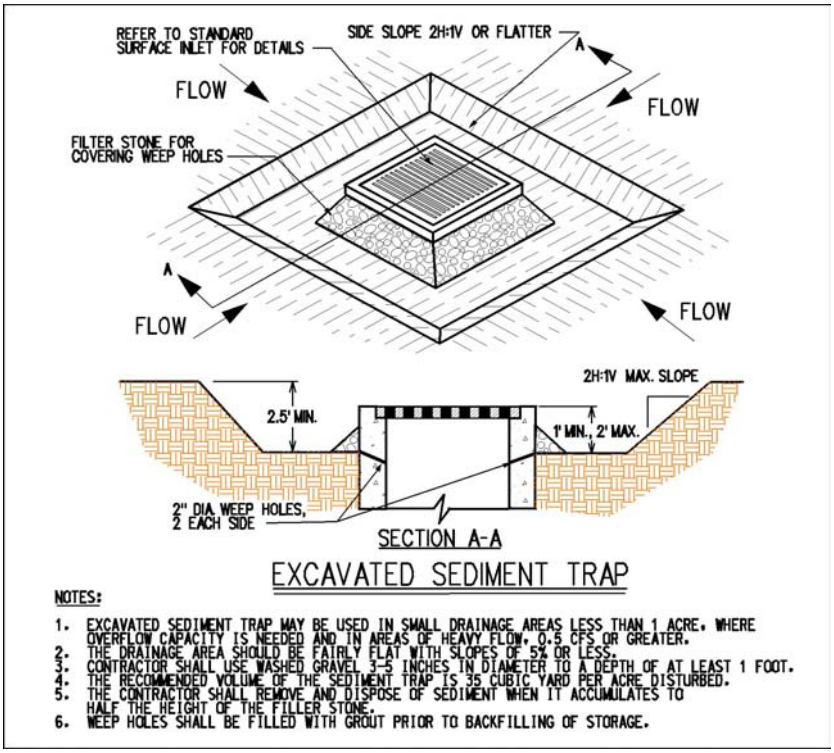


Figure 7d. An illustration of a sediment trap stormwater control structure.

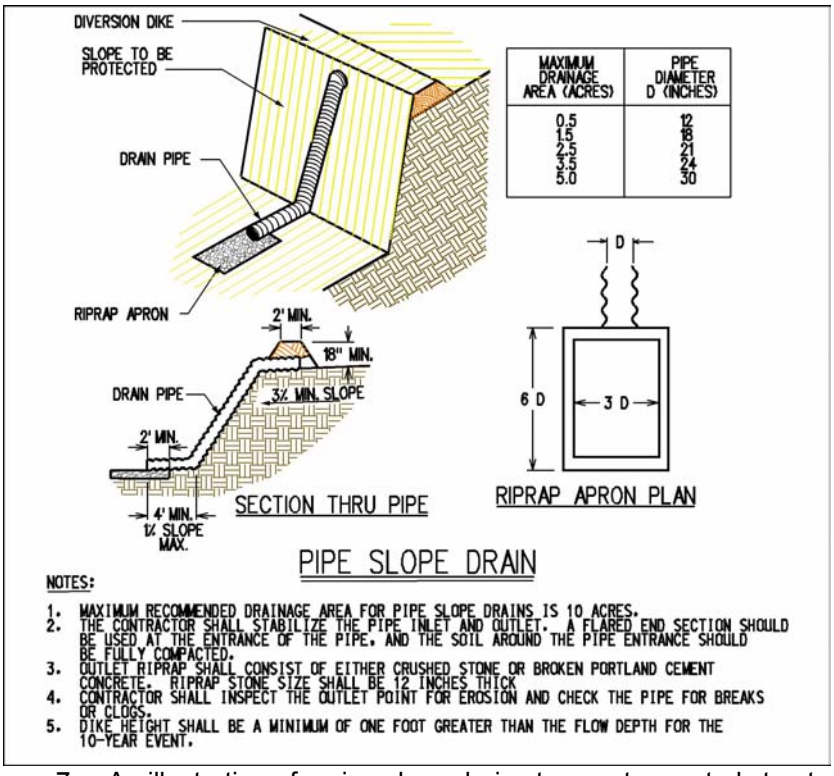


Figure 7e. An illustration of a pipe slope drain stormwater control structure.

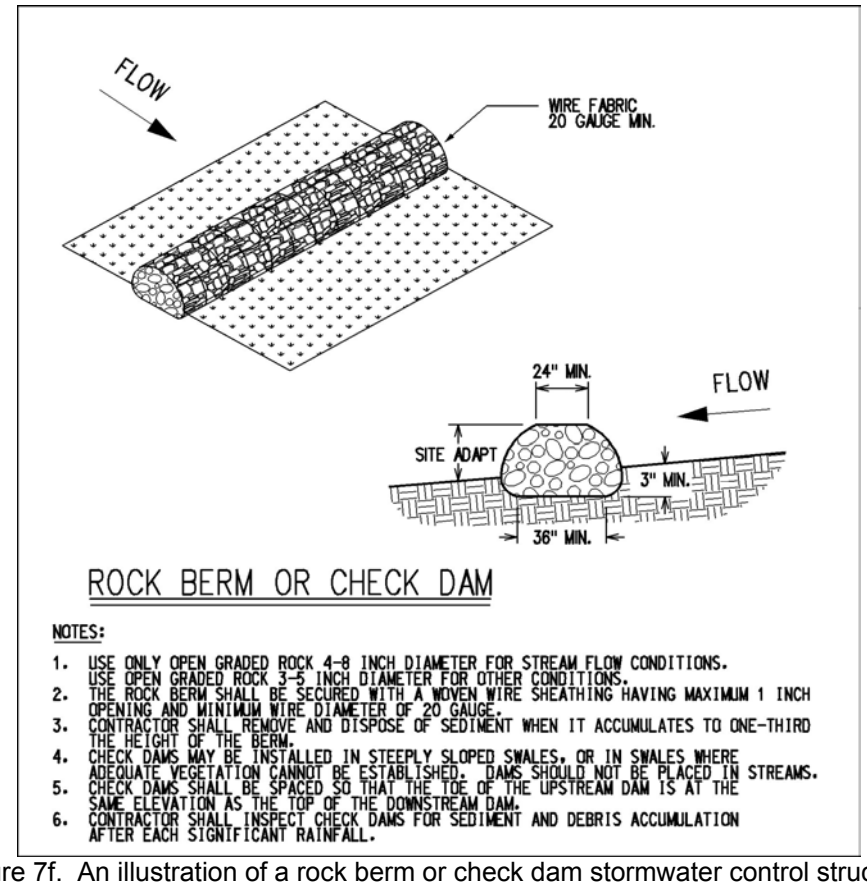


Figure 7f. An illustration of a rock berm or check dam stormwater control structure.

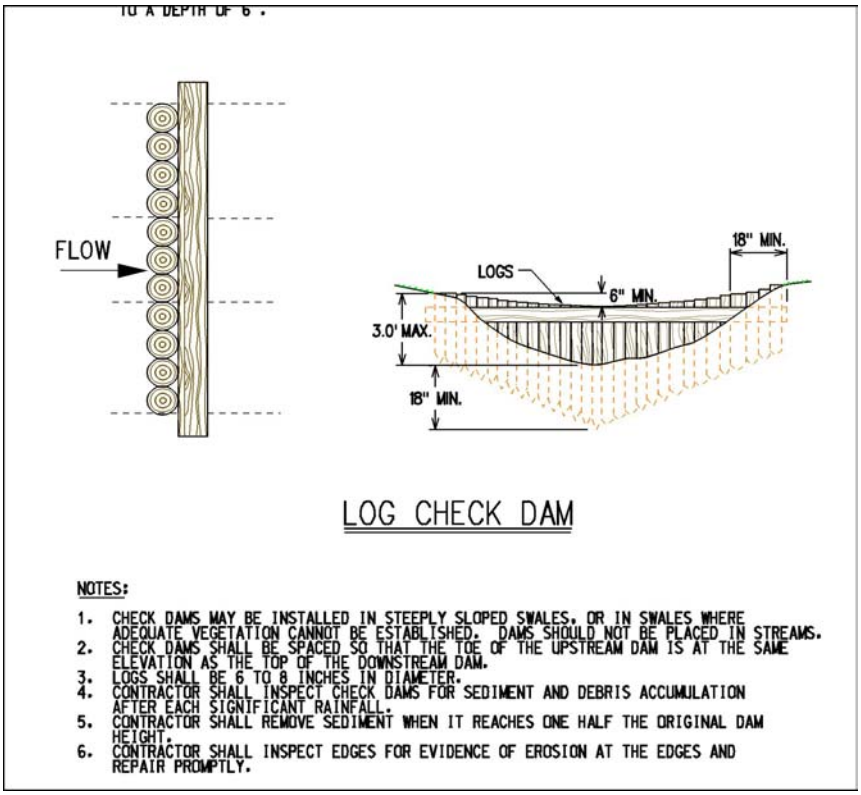


Figure 7g. An illustration of a log check dam stormwater control structure.

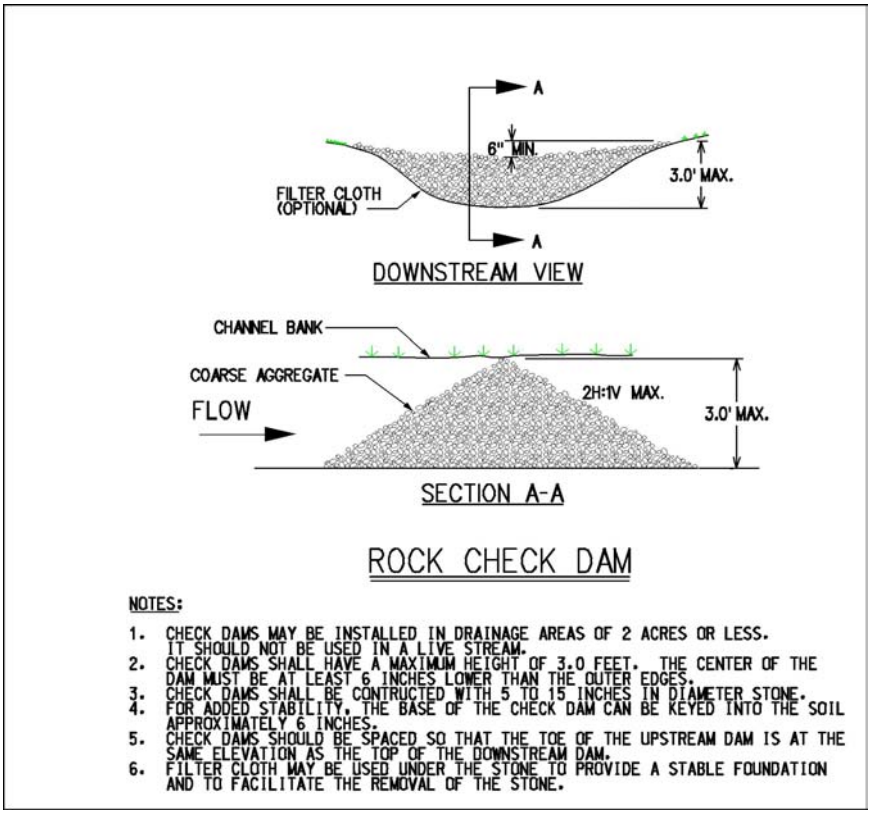


Figure 7h. An illustration of a rock check dam stormwater control structure.

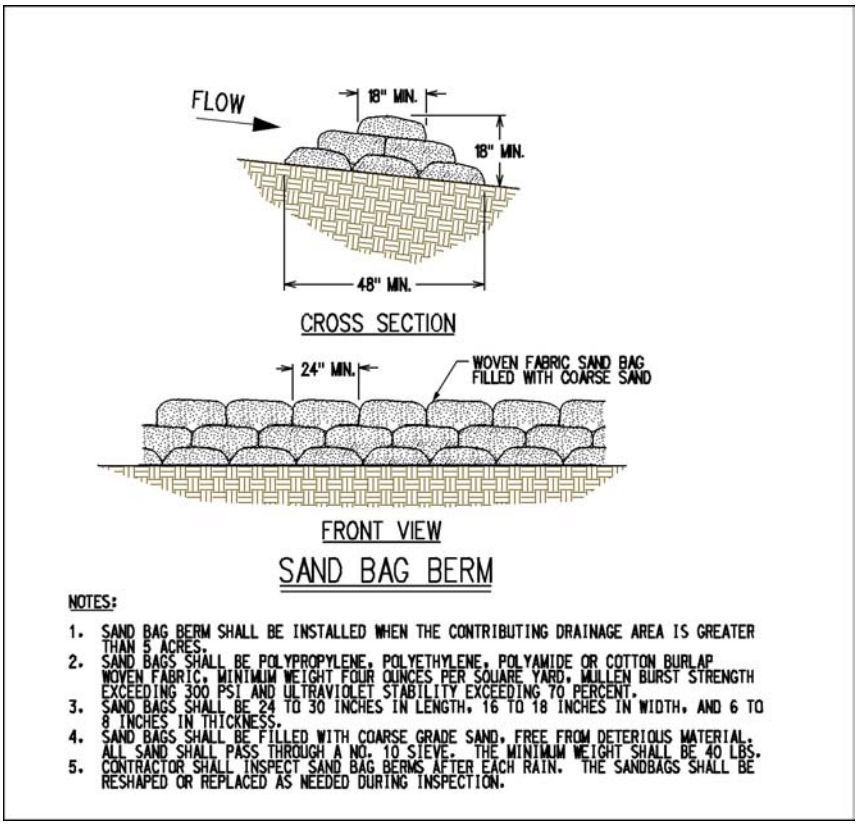


Figure 7i. An illustration of a sand bag berm stormwater control structure.

AIR QUALITY

Construction activity associated with the implementation of the recommended plan would result in temporary adverse impacts to air quality from fugitive dust production, smoke, and construction vehicle emissions. There would be no stationary emitting sources and no on site storage of petroleum or petroleum based by-products to cause additional negative impacts to air quality. Disposal of cleared vegetation or other debris by burning would not be allowed. Maintenance activities required for the recommended plan would contribute small amounts of additional mobile air emissions.

The reduction in tree canopy area and other perennial and annual vegetation from clearing activities for hydraulic channel construction would result in negative impacts through elimination of biogenic sources that remove regulated gaseous air pollutants.

DISPOSAL OF MATERIAL

General Description Of Dredged Or Fill Material

General characteristics of the material that would be considered fill would result from the incidental migration of alluvial stream bank deposits during the excavation and shaping of the hydraulic channel. These alluvial deposits are low to medium plasticity clays, clayey sands, and gravel. The clay is typically brown to light brown, firm to hard, silty, sandy, and gravelly. The sand and gravel are typically dark brown to light brown, poorly graded, silty, and clayey. Other filling would result from using large limestone cobbles/boulders as riprap to armor sections of the channel around bridges and diversion channels.

Quantity Of Material

It is estimated that approximately 415 cubic yards of incidental bank material would result in fill and that approximately 5,290 cubic yards of rip rap, berm backfill and gabion lining and 4,800 cubic yards of concrete paving would be used in the channel to stabilize bank slopes. The incidental alluvial material would originate on site. The riprap (free and in gabion baskets) and concrete would originate off site.

Discharge Of Material

The proposed discharge would occur along the segments of Little Fossil Creek where excavation and points of bank stabilization occur. The proposed flood damage reduction project would result in discharges along the full length of Little Fossil Creek where excavation is occurring. It is anticipated that work would occur along approximately 7,500 linear feet of Little Fossil Creek and includes a 30-foot zone of non-wetland jurisdictional waters, impacting a total area of about 4.04 acres. The area proposed for excavation along Little Fossil Creek is an unconfined site that flows freely during local or regional rain events. It is anticipated that any discharges associated with the proposed project would occur only during construction activities and only during periods when the possibility for discharges are minimal. A storm water pollution plan (SWPPP) would be developed for this project that would outline any and all measures necessary to temporarily and permanently stabilize the disturbed area and minimize discharge of materials into Little Fossil Creek during construction. The SWPPP would also provide a plan to permanently stabilize the project area following implementation.

Actions Taken To Minimize Impacts

During plan formulation several different alignments and sizes of channel were investigated to provide flood damage reduction benefits and to minimize impacts to the aquatic and riparian zones which some with the specific intent of minimizing impact to forested banks. It was determined that following the general alignment of the existing channel caused less impacts to higher quality mast bearing trees in the floodplain. To further minimize impacts to the forested riparian zone and consequently to function of the aquatic habitat, the flood damage reduction channel plan was modified to include one-sided channel cut geometry in order to preserve the existing thalwag and stream bank vegetation. Four areas, each along the left descending bank of the channel were identified where vegetation would not be removed from the streambank. These areas total approximately 750 linear feet. In most areas this was not possible because of constraints relating to parcel ownership and engineering design constraints, such as minimum channel capacity and bank stabilization requirements.

In response to comments received from Texas Natural Resource Conservation Commission during the public review of the draft DPR and Integrated Environmental Assessment, and U.S. Fish and Wildlife Service additional evaluation of off channel detention was conducted. Specifically, further alternative analysis was conducted on a non-developed site consisting of

approximately 42 acres in size located to the southwest of Little Fossil Creek just upstream of the Highway 121 crossing.

In order to evaluate potential economic benefits of this floodwater detention alternative, it was necessary to develop a correlation between peak discharge and single-event damage, within the primary reach of interest, which extends from Midway Road to Carson Street. As an initial test, the existing condition hydrologic storages in the primary reach were incrementally increased and an evaluation was made regarding the potential flood damage reduction benefits of each increment. A 10 percent increase in valley storage was found to provide approximately $107,000 in expected annual benefits. Assuming the additional storage (163 acre-feet) would be obtained via direct excavation, this alternative was estimated to require in excess of $95,000 in annualized implementation cost (for excavation alone; ignoring real estate costs, etc.). This plan would therefore have a benefit-to-cost ratio (BCR) of less than 1.13. This process was continued for valley storage increase increments up through 50 percent, as shown in the following array:

Increase in Valley Storage	Expected Annual Benefits (dollars)	Expected Annual Costs (dollars)	Benefit-to-Cost Ratio
10	$107,000	> $95,000	< 1.13
20	$222,000	> $189,000	< 1.17
30	$326,000	> $284,000	< 1.15
40	$425,000	> $379,000	< 1.12
50	$528,000	> $473,000	< 1.12

Each of these alternatives would appear to have economic feasibility. However, after costs have been included for real estate acquisition, relocations of utilities, and operations/maintenance, the Benefit-to-Cost Ratio would be reduced to a level that is substantially below unity, and thus there would be no Federal Interest in implementation of this measure.

In conclusion, every effort was made to avoid or preserve valuable aquatic and terrestrial habitat concurrent with achieving the flood damage reduction objectives. Areas of high quality habitat would be avoided were feasible by shifting channel alignment or by utilizing earthen material rather than concrete Additional adverse impacts would be minimized through implementation of storm water pollution prevention control measures such as silt fences and temporary and permanent soil stabilization practices such as netting and planting of fast-growing native grasses. To compensate for unavoidable adverse impacts, a natural resource or habitat mitigation plan as well as an aquatic mitigation plan has been developed and would be implemented concurrently with project construction.

SECTION 404 – CLEAN WATER ACT

The proposed project has been reviewed in accordance with Section 404(b)(1) guidelines (40 CFR Part 230) promulgated by the U.S. Environmental Protection Agency pursuant to Section 404 of the Clean Water Act for evaluation of the discharge of dredged and fill material into waters of the United States. The possible consequences of the recommended plan have been considered in accordance with regulations published in 33 CFR Parts 320 and 330 and 40 CFR part 230. A Section 404(b)(1) analysis is contained in Appendix C. On the basis of the guidelines, the recommended plan for the Little Fossil Creek Flood Damage Reduction Project would be specified as complying with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem and to implement and abide by the mitigation plan in this document.

SECTION 401 – CLEAN WATER ACT

Section 401 of the Clean Water Act (33 U.S.C. 1341) requires that any activity which could result in a discharge of a pollutant into waters of the United States obtain a certification from the

State in which the discharge would originate and that the discharge comply with applicable effluent limitations and water quality standards. The proposed project is in compliance with Section 401 of the Clean Water Act. Responses to TNRCC 401 questionnaire are presented in Appendix C (Page C-19).

CULTURAL RESOURCES

As a result of investigations performed during this study, it has been determined that there would be no historic properties affected. No further archaeological investigations are necessary if the proposed project impact areas do no shift of expand. An archaeological survey report was coordinated with the State Historic Preservation Officer by letter dated April 24, 2000, who has concurred with the Corps' determination of No Historic Properties Affected (36 CFR 800.4(d)(1). However, borrow and disposal areas had not been defined at the time that the investigations were performed, and will be the subject of an additional cultural resources effort at a later time. During project construction, if any currently unidentified cultural resources are encountered, all work in that location will cease and a qualified archeologist will be consulted.

FEDERAL ENVIRONMENTAL REQUIREMENTS

Endangered Species Act. As proposed, the recommended plan would not adversely impact any Federal or state listed threatened or endangered, or critical habitats.

Executive Order 11990 – Protection of Wetlands. Executive Order 11990, Protection of Wetlands, was considered during planning of the proposed project. The recommended plan would not adversely impact or result in the loss of any wetland areas. The recommended plan would be in compliance with Executive Order 11990.

Executive Order 11988 – Floodplain Management. Executive Order 11988, Floodplain Management, was considered during the planning of the proposed project. There are no practical alternatives to achieve the project purposes of flood damage reduction without working in the floodplain. Following project implementation, development of the Little Fossil Creek floodplain would be managed. This would occur in accordance with Section 202(c) of the Water Resources Development Act of 1996, and the Federal requirement that within one year of project implementation, Haltom City develop and submit a FPMP. The proposed project is in compliance with Executive Order 11988.

Executive Order 12898 – Environmental Justice. Executive Order 12898 provides that each Federal agency identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States. Adverse impacts associated with implementation of the recommended plan would not have disproportionate impacts on minority or low-income populations.

DISCUSSION OF USFWS FINAL COORDINATION ACT REPORT RECOMMENDATIONS

In the draft Fish and Wildlife Coordination Act Report, dated 19 June 2001, the U.S. Fish and Wildlife Service (Service) recognizes that the Little Fossil Creek Flood Damage Reduction Project would adversely impact high quality terrestrial and aquatic resources. For adverse impacts to terrestrial resources, the Service recommends the acquisition and management of approximately 65 acres of mitigation lands consisting of grassland/old fields and bottomland hardwoods contiguous to the project area. Compatible activities in the mitigation area could include hiking, nature trails, or other similar low-density recreation opportunities. The Service recommends planting a minimum of 80 hardwood, mast-producing trees and 40 fruit-bearing shrubs as management in open grassland areas of the mitigation site. The Service also suggests using a mixture of native grasses and forbs to stabilize soils on newly constructed channel side slopes. To mitigate for impacts to aquatic resources, the Service recommends limiting impacts to

one side of the channel, where feasible, preserving current stream substrate where possible, and requiring that maintenance activities take place during specific times to minimize disturbance to wildlife during bird nesting. Compensation for unavoidable impacts to aquatic resources is recommended by the Service through the construction of a low-flow channel where the proposed channel modifications cut into the existing channel bottom, the construction of low-water retention structures and wing deflectors along the stream to create pool habitat, and the establishment of 10 acres of vegetated wetland habitat within an inactive gravel quarry lake in the mitigation area.

FEDERAL AND STATE THREATENED AND ENDANGERED SPECIES, AND CRITICAL HABITATS

As proposed, the recommended plan would not adversely impact any Federal or state listed threatened or endangered, or critical habitats.

ENVIRONMENTAL MITIGATION

General

Every effort was made during the planning stages of this project to avoid or minimize adverse impacts to terrestrial and aquatic natural resources. Unavoidable adverse impacts of this project would be mitigated by replacement of lost natural resources with habitat of the same or greater functional capacity and quality. In cooperation with the U. S. Fish and Wildlife Service and Haltom City officials, a 95-acre site was identified as a potential area for mitigation. The Corps and the U.S. Fish and Wildlife Service jointly developed a wildlife mitigation plan for adverse impacts of the proposed project. The Fish and Wildlife Coordination Act Report is included in Appendix L.

Mitigation Plan

The proposed mitigation area for the Little Fossil Creek flood damage reduction project is located at the southern terminus of the project area, between the east bank of Little Fossil Creek and the Trinity Waste Landfill, south of the Rail Tran railroad line (Appendix C, Figure 1, Page C-9). The mitigation area is comprised of 11.04 acres of forested habitat, 19.89 acres of open water, and 33.11 acres of scrub shrub/old field habitat. The water body is an old gravel quarry with little or no aquatic habitat present. Preliminary coordination with the Fish and Wildlife Service has indicated that a possible mitigation plan for this area could include converting all old field/scrub shrub habitat to a bottomland hardwood riparian forest community by planting such species as pecan, bur oak, red oak, red mulberry, coral berry, Indian cherry, etc in the appropriate densities (80 trees and 30 – 40 shrubs per acre). An additional restoration feature of the mitigation area would be to use clean excavated overburden from the project to create 10 acres of shallow water wetland habitat. Populations of native aquatic plants would then be established in the shallow water through deliberate planting. Further definition of the mitigation plan for aquatic habitat will occur during the development of project Plans and Specifications.

Unavoidable losses to aquatic habitat could be mitigated in several ways. Onsite and offsite locations were initially considered. However, it was determined that the overall best scenario to accomplish compensatory mitigation would be through modification of the project onsite. Mitigation goals of both the Corps of Engineers and U.S. Fish and Wildlife Service support onsite mitigation. This meets the objective of providing the mitigation close to the location of the impact and facilitates maintenance of the mitigation area, which would be required of the local cost-sharing sponsor.

The ROSGEN stream classification system incorporating six morphological characteristics such as entrenchment, width/depth ratio, sinuosity, channel number, slope, and bed material particle size, indicates that Little Fossil Creek is an E type stream. Characteristics of this type stream are slight entrenchment and moderate sinuosity. The bedform features are consistent

riffle/pool sequences with the pools occurring at the outside bends of meanders and the riffles in-between. Because some channelization has already occurred along Little Fossil Creek, there are some existing irregularities in this sequence.

The methodology was used to determine a stream channel restoration plan, which recreates the pre-disturbed meander pattern and sinuosity. Stream channel planform was determined using a reference reach. A reference reach is one that is used as a template for the geometry of the restored channel since it is determined to be stable with a desirable morphological and ecological condition and that is similar to the hydrology, sediment load, and bed and bank material of the project area. This condition was identified in the northern reach of the project area between Belknap and Midway. In this reach, the meander wavelength encompassing the riffle/pool sequence is approximately 575 feet, which is approximately 6.5 times the channel width. This falls within the suggested range for a stable stream of this type.

After applying this technique to the post construction channel configuration the approximate location of the meander bends and resulting riffle and pool areas were identified. The upper reach between Belknap and Midway will be restored to the existing condition of one meander wavelength that consists of 3 riffles, each occurring at the inflection points, and 2 pooled areas, as shown in Figure 8. The reach between Midway and the upstream end of the concrete channel, approximately 3,000 feet in length, will be designed to restore 6 meanders that will include 12 riffles and 12 pools.

And finally, the southernmost reach from Carson to the downstream limit of the project will contain 1 meander including 3 riffles and 3 pools. The geometry of a naturally meandering stream varies with each channel cross-section, based on width, depth and slope. The stream channel geometry would vary from reach to reach but will follow the channel sections as shown on attached Figure 9.

In addition to the excavation of the stream channel to provide the meander restoration, other instream techniques will be applied, where feasible, which will include boulder clusters, rock check dams, and natural channel constrictors and deflectors. These, too, will encourage meander development and pool formation, and reduce silt buildup originating from upstream of the project area within the riffles. A conceptual view of the plan in the downstram reach is shown in Figure 10.

This sequence of pools and riffles would provide replacement structure and function for the 18 riffles disturbed during construction of the flood conveyance channel. The pools would cover an area similar in size to the pools and runs currently on-site. The restored meanders would result in the stream flowing closer to the banks within the new channel bottom allowing more shading and less temperature increases than would occur with a maintained straight line channel. These features would compensate for the aquatic functions impacted by the flood control project. In addition, the environmental mitigation plan proposed in the project report for terrestrial resources includes the acquisition of a flood plain lake and adjacent riparian woodlands. This site is located just downstream of the proposed channel project and would continue to remain within the flood plain of both the Little Fossil Creek and West Fork of the Trinity River. This lake would be modified as outlined in the project report to provide at least 10 acres of shallow areas that would be planted with aquatic plants. Subsequent overbank flooding would inundate this area providing for water quality improvement for the Little Fossil Creek below the project and from the confluence with Big Fossil Creek to the West Fork of the Trinity River.

An initial cost analysis of developing the channel meanders, pools and riffles has been conducted and it has been determined to be engineeringly and economically feasible to include. The excavations required to route the thalweg and to provide the pool reaches is estimated to cost about $80,000. An additional $20,000 in place of natural rock structures to maintain the pools and establish riffles would likely be required. Large quantities of gravel and cobble located within channel reach 5 would be stockpiled at an upland site and reintroduced into the mitigation

riffles area. The restoration of riffles and pools following the ROSGEN methodology within the impacted reaches of Little Fossil Creek and implementation the mitigation plan as outlined within the project report would fully compensate unavoidable project impacts to aquatic and terrestrial impacts. Therefore the aquatic mitigation plan as outlined is recommended for implementation.

In addition, starting 1 year after completion of construction of aquatic mitigation features, the project area will be studied if impacted functions of the aquatic ecosystem are returning. The Corps will use the methodology endorsed by the U.S. Fish and Wildlife Service to indicate the degree that biotic integrity has been restored. If functions have not been restored after 3 years, then other mitigation actions will be conducted.

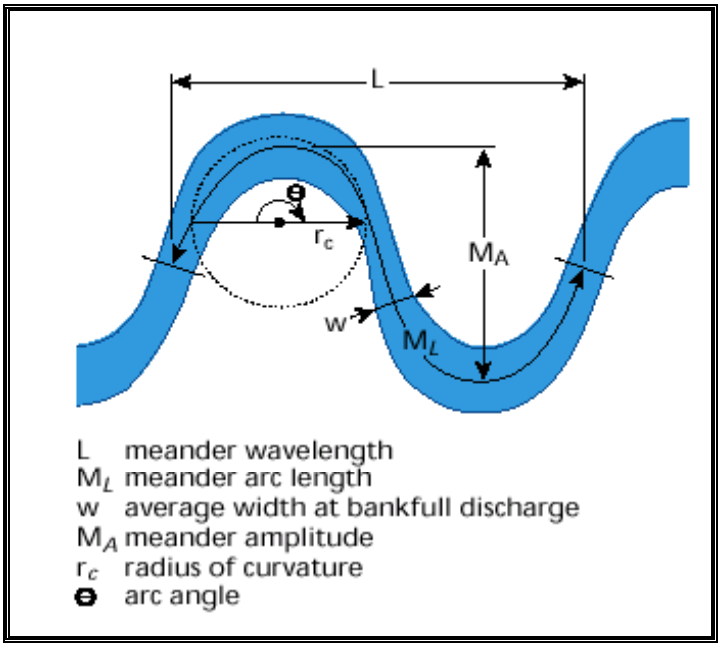


Figure 8 – Meander Geometry

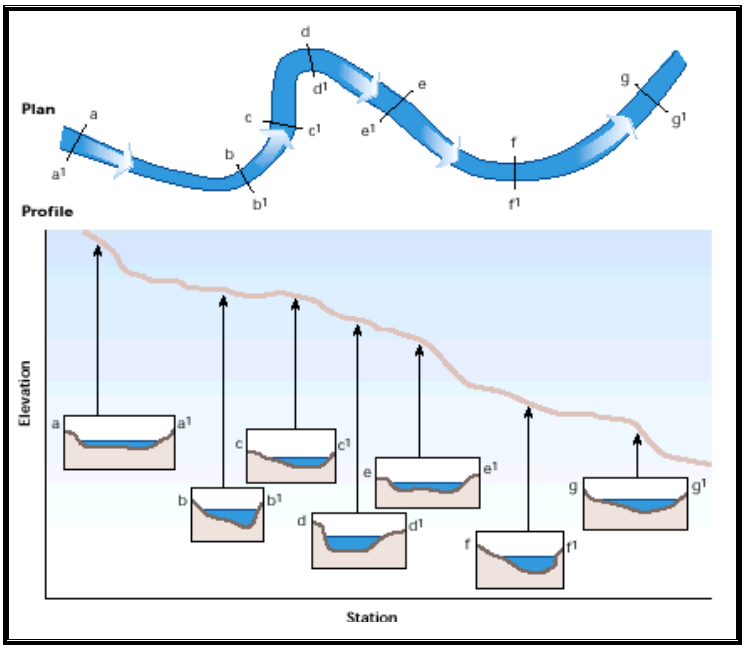


Figure 9 – Natural Meander Plan and Profile

LITTLE FOSSIL CREEK

CONCEPTUAL DESIGN

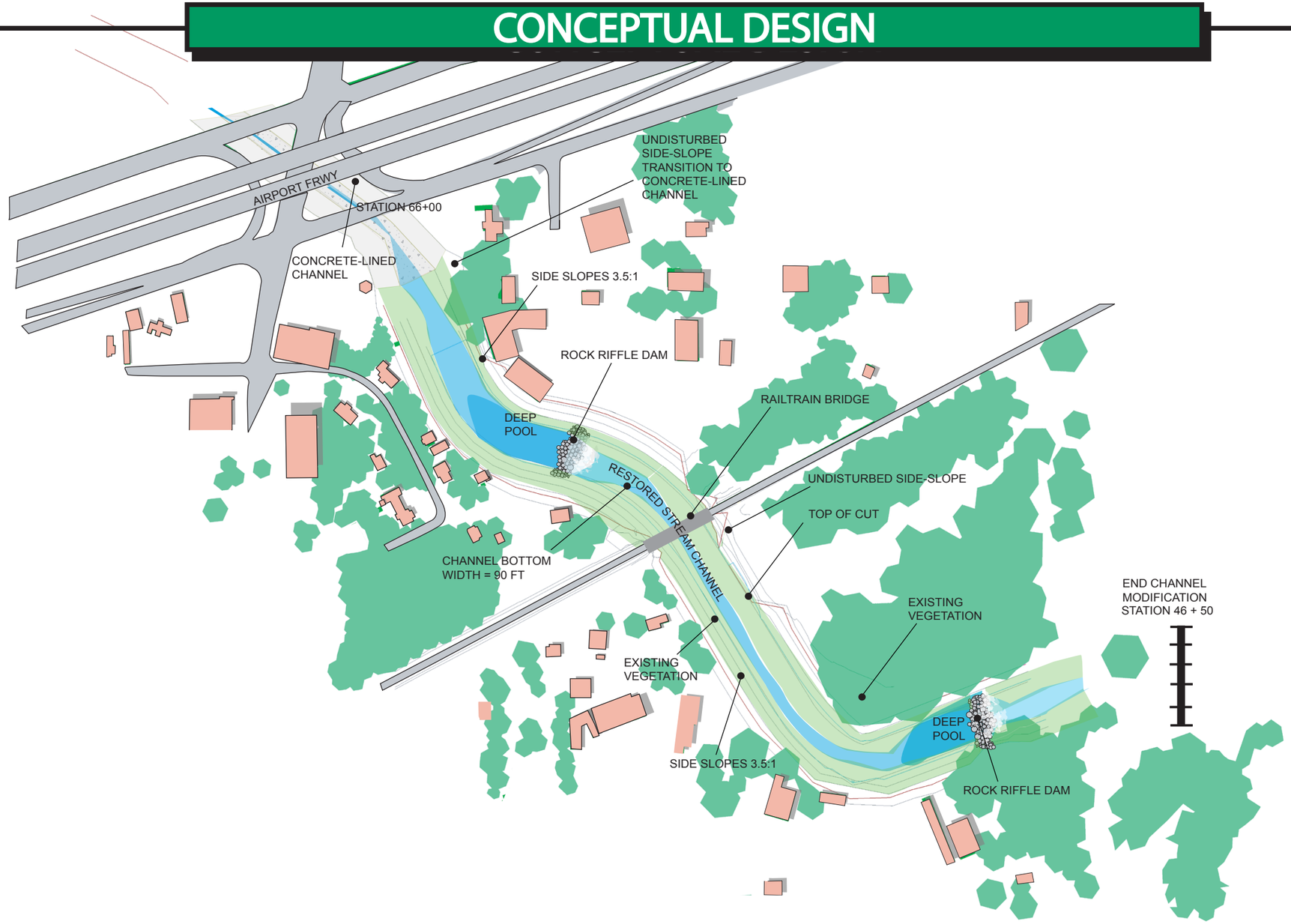


Figure 10

Aquatic Mitigation Features

ECONOMICS OF THE RECOMMENDED PLAN

COSTS

The economic cost of the Recommended Plan includes estimates for construction, engineering and design, supervision and administration, and lands and damages, with allowances for contingencies. Using current material, equipment, and labor costs typical for work of this nature in the Haltom City vicinity developed cost data. Table 9 gives a summary of first costs for the Recommended Plan. A detailed presentation of the project costs is included in Appendix K, Cost/Specs, of this report. The estimate of first costs is based on May 2001 prices. These costs are not directly comparable to those shown previously in the formulation documentation.

A 19-month construction period for this project was assumed for the purpose of determining the total investment. The estimate for annual costs for the Recommended Plan is based on the current Federal interest rate of 6.375 percent with the cost of the project amortized over a 50-year period of analysis. A summary of the estimated annual costs for the Recommended Plan, including interest during construction, investment cost, and operation and maintenance are shown in Table 9 below.

Table 9
Little Fossil Creek Channel Modification Project
Summary of Costs for the Recommended Plan

Account	*Description*	*Estimated Cost*	*Percent Contingency*	*Contingency*	*Total Cost*
02	Relocations	$22,300	20.00%	$4,500	$26,800
06	Fish and Wildlife Mitigation	$140,100	8.00%	$11,200	$151,300
09	Channels and Canals	$4,621,200	23.00%	$1,062,900	$5,684,100
14	Recreation Facilities	$506,500	33.00%	$167,100	$673,600
Total Construction Cost		**$5,290,100**		**$1,245,700**	**$6,535,800**
01	Lands and Damages	$2,897,000	18.08%	$523,700	$3,420,700
30	Engineering and Design	$361,100	21.85%	$78,900	$440,000
31	Supervision and Administration	$548,100	25.00%	$137,000	$685,100
Total Project Costs		**$9,096,300**		**$1,985,300**	**$11,081,600**

BENEFITS

Average annual benefits were determined by subtracting the Recommended Plan residual flood losses from the "Without Project" flood losses. Table 10 displays the economic summary of The Recommended Plan. Expected annual damages with the project in place would be $376,000. This represents a reduction of 82 percent from the existing, unimproved condition. Expected annual flood control benefits would be $1.815 million, with additional recreation benefits of $600,000. The resultant benefit-to-cost ratio for the Recommended Plan is 3.0.

Table 11, parts A and B, contain the number of structures inundated by flood zone for existing conditions and with project conditions, respectively. A total of 540 structures were removed from the 100-year floodplain within the study area.

More details regarding the effectiveness of the Recommended Plan can be found in Appendix D.

Table 10
Economic Summary of the Recommended Plan
(*May 2001 prices, 6.375% interest)*

Recommended Plan with Recreation	
Investment	
Estimated First Cost	$11,081,600
Annual Interest Rate	0.06375
Project Life (Years)	50
Construction Period (Months)	19
Investment Cost	$11,641,900
Annual Charges	
Interest	$742,200
Amortization	$35,400
Operation/Maintenance ($/Year)	$25,000
Replacements	$0
Total Annual Charges	**$802,600**
Annual Benefits	
Inundation Reduction	$1,815,000
Recreation	$600,000
Total Benefits	**$2,415,000**
Net Benefits	**$1,612,400**
Benefit-To-Cost Ratio	**3.0**

Table 11A
Number of Inundated Structures By Flood Zone Under Existing Conditions

Existing Conditions	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	250-Year	500-Year
Reach 1	0	0	1	8	18	40	54	78
Reach 2	0	7	23	32	35	39	45	52
Reach 3	0	0	11	71	96	127	158	177
Reach 4	0	0	83	111	132	150	177	204
Reach 5	0	0	167	197	221	235	247	254
Reach 6	0	0	15	22	28	33	36	38
Total	**0**	**7**	**300**	**441**	**530**	**624**	**717**	**803**

Table 11B
Number of Inundated Structures By Flood Zone With the NED Plan (CI-75 foot average width channel)

With project Conditions	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	250-Yr	500-Yr	Removed From 100-Year
Reach 1	0	0	1	7	17	40	55	77	
Reach 2	0	0	0	5	15	32	44	51	
Reach 3	0	0	0	0	0	0	92	158	
Reach 4	0	0	0	0	0	0	47	87	
Reach 5	0	0	0	0	0	0	215	235	
Reach 6	0	0	6	9	10	12	22	25	
Total	**0**	**0**	**7**	**21**	**42**	**84**	**475**	**633**	**540**

DIVISION OF PLAN RESPONSIBILITIES

NON-FEDERAL RESPONSIBILITIES

Non-Federal local interests would provide the following:

- Hold and save the United States free from damages due to construction and subsequent operation and maintenance of the project, except any damages due to the fault or negligence of the United States or its contractors;

- Provide without cost to the United States, all lands, easements, rights-of-way, including borrow and dredged material disposal areas, necessary for construction and maintenance and operation of the project;

- Bear the cost of all alterations and relocations of buildings, utilities, storm drains, roads, highway bridges, and community services;

- Provide cash contribution equal to 5 percent of total project costs.

- Provide an additional cash payment when the sum of items (b), (c), and (d) is less than 35 percent of total project costs; if the sum of items (b), (c), and (d) should exceed 50 percent of total project costs, local contributions in excess of 50 percent will be reimbursed by the Federal Government unless the Recommended Plan is a buy out plan.

- Maintain and operate the project after completion, including accomplishment of any needed repair, replacement or rehabilitation of any of its components.

- Prevent future encroachments, which might interfere with proper functioning of the flood control project;

- In addition to its other cost sharing responsibilities, assume full responsibility for all project costs in excess of the Federal cost limitations of $7,000,000.

- Provide for any costs incurred in cleanup of hazardous materials located on project lands and covered under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) shall be considered a non-Federal responsibility for which no cost sharing credit can be given; and, the project sponsor shall be required to operate, maintain, repair, replace, and rehabilitate the project in a manner so that liability will not arise under CERCLA;

- Provide for the full non-Federal cost of maintenance of trees that would be required by the environmental mitigation plan;

- Participate in and comply with applicable Federal floodplain management and flood insurance programs (i.e. the National Flood Insurance Program), pursuant to Section 402, Public Law 99-662; and provide guidance and leadership to prevent unwise future development in the floodplain.

- In compliance with ER 1165-2-121, the local sponsor would not qualify for ability-to-pay revisions to the standard level of project cost sharing.

COST APPORTIONMENT

Sharing of costs between Federal and non-Federal interest for non-reservoir type flood control improvements is based on standard requirements that are set forth by law. Under these requirements, the non-Federal project sponsor is required to furnish all lands, easements, and rights-of-way necessary to construct the project. In addition, the local sponsor is required to relocate all affected utilities and buildings. A minimum cash contribution equal to 5 percent of the project implementation cost associated with flood damage reduction is also required from the local sponsor prior to initiation of construction.

As part of the Recommended plan, costs attributed to the fish and wildlife mitigation requirements (excluding lands), such as the planting of appropriate species of trees and the creation of a mitigation area, are included in the estimated cost for environmental mitigation. The estimated cost for environmental mitigation, excluding additional lands, is $151,300. There are no special rules for fish and wildlife mitigation costs; all land costs are non-federal, and costs of plantings or other modifications are construction costs, which are Federal.

All recreation facilities, which have been added to this project, will be cost shared at a 50-50 split. Federal participation in recreation facilities cannot increase the Federal cost associated with the flood project by more than 10%.

The local sponsor is responsible for operating and maintaining, repair, replacement, and rehabilitation of the completed project features following construction in accordance with Corps requirements. The Federal Government is responsible for all remaining flood control construction costs. Under Section 205 of the Flood Control Act of 1948, as amended, Federal expenditures for a local flood control project are limited to $7 million dollars in any one locality (project). In addition, the non-Federal expenditures for a Section 205 project which has been identified as the NED plan, shall be at least 35 percent, but not exceed 50 percent of the total project first cost. Table 12 shows the proposed apportionment of the project first cost between the Federal Government and Haltom City in accordance with the policies outlined above. The first cost of the Recommended plan is estimated to be $11,081,600. Of particular note is that an additional cash contribution of $140,250 is anticipated from Haltom City, due to the $7 million Federal implementation cost limit. Federal implementation costs are composed of the project cost as well as the $347,700 in study costs.

Table 12
Little Fossil Creek Channel Modification Project
Cost Apportionment for the Recommended Plan

Feature	*Federal*	*Non-Fed*	*Total*
Relocations		$26,800	$26,800
Channels and Canals	$5,684,100		$5,684,100
Recreation	$351,050	$351,050	$702,100
Lands and Damages		$3,392,200	$3,392,200
Planning, Engineering, and Design	$440,000		$440,000
Supervision and Administration	$685,100		$685,100
Fish and Wildlife Facilities	$151,300		$151,300
5 % Cash by Non-Fed Sponsor	($519,000)	$519,000	
Subtotal	$6,792,550	$4,289,050	$11,081,600
Additional Cash by Sponsor	**($140,250)**	**$140,250**	
Apportionment Totals	**$6,652,300**	**$4,429,300**	**$11,081,600**
% Breakout	**60.0%**	**40.0%**	

PLAN IMPLEMENTATION

The plan of improvement recommended in this report will be subject to a series of review and procedures before it can be completed as a Federal project. The following steps are involved in the review and implementation process:

- Review and approval of Detailed Project Report by the Division Engineer.
- Division request funding for the preparation of plans and specifications of the Recommended Plan
- Preparation of construction plans and specifications.
- District review and approval of plans and specifications
- Review of the model Project Cooperation (Cost Sharing) Agreement, without deviations, by the Division Office of Counsel. A PCA with deviations must receive Headquarters approval.
- Approval of the project for construction by the Division Engineer.
- Commitment of construction funds by Headquarters
- Execute the Project Cooperation (Cost Sharing) Agreement between the Corps and Haltom City.
- Haltom City acquires the necessary real estate and performs all necessary relocations, except for railroad bridges, for construction and maintenance of the project.
- Advertise construction contract.
- Receipt of the Local Sponsor's cash contribution.
- Headquarters allocates Federal construction funds.
- Award the construction contract.

The formal execution of local cooperation agreement, as stated above, will be required before construction of the project can begin.

PUBLIC AGENCY COORDINATION

The cultural resources component of this study considers the legal responsibilities and obligations of the U.S. Army Corps of Engineers, Fort Worth District, with respect to all applicable cultural resources laws, Executive Orders, Presidential Memoranda, and U.S. Army Corps of Engineers Regulations. Principally among these, but not limited to, is the *National Historic Preservation Act* (NHPA) *of 1966* (PL 89-665 *et seq*.); the *National Environmental Policy act* (NEPA) *of 1969* (PL 90-190 *et seq*.), the *Native American Graves Protection and Repatriation Act* (NAGPRA) *of 1990* (PL 101-601), Executive Order 13007 (*Accommodation of Sacred Sites* - 24 May 1996), *Government-to-Government Relations with Native American Indian Tribal Governments* (Presidential Memorandum of 29 April 1994), and Engineer Regulation (ER) 1105-2-100 (*Guidance for Conducting Civil Works Planning Studies*). The TXSHPO was informed of this project in February 2000 to coordinate an area of potential effect definition and a scope of effort to determine the presence of historic properties within the project area. The study effort currently being completed, and its results, will be coordinated with the TXSHPO per the requirements of Section 106 of the NHPA. All subsequent determinations of effect and avoidance or mitigation effort required will also be coordinated with the appropriate agencies. Native American Indian tribes with cultural affiliation to the region will be contacted to determine if properties of cultural significance are located within the project area. Any discoveries made during the present survey effort or as discovered during project execution attributable to protection as part of NAGPRA will require separate consultation.

FINDINGS AND CONCLUSIONS

Structures located within the Little Fossil Creek study area are prone to frequent flooding. The 803 structures located within the 500-year limits of the study area are estimated to sustain $2,091,000 in average annual flood losses for present conditions. The October 1981 flood is the flood of record, estimated at a 1 percent chance exceedance (100 year frequency) event. It caused approximately $10 million in damages (in 1981 dollars).

The Recommended Plan consists primarily of a 75-foot average bottom width, combination grass- and concrete-lined trapezoidal channel with one-sided, alternating bank side slope cuts where possible. The plan would begin approximately 1,100 feet downstream of the Railtran Bridge and proceed upstream to a point just downstream of the Belknap Bridge. The total project has an aggregate length of 7,350 feet, which includes channel widening and deepening, including erosion control features where necessary. In order to provide the needed channel capacity to pass the 100-year storm event through the Carson Street/S.H. 121 Bridge group, while sustaining velocities up to 15 fps with minimal friction losses, a 45-foot bottom width concrete-lined, trapezoidal channel with 1.5:1 side slopes will be constructed. This channel configuration is the largest allowable without replacing the bridge structures, while still preventing the split flow to the east. The Recommended Plan also calls for gabion lining to be used in the section just upstream of the Midway Road Bridge.

The Recommended Plan also proposes a multi-purpose trail designed to provide access for hiking, jogging, bicycling and nature study. The plan consists of approximately 6,250 linear feet of ten-foot wide concrete multi-use trail along the west side of Little Fossil Creek, connected by a low-water crossing to an additional 6,000 linear feet of six – eight foot unsurfaced nature trail, circling a small lake in the mitigation area.

The trail system will be easily accessible from adjacent neighborhoods. Residents who do not live nearby will be able to drive and park their vehicles at one of the four access areas located on Orval Court, Belknap Street, Garden Street, and the Mitigation Area.

Implementation of the Recommended Plan will cause the displacement of seven residences and one horse barn. All of these residences are located along Orval Court on the west side of Little Fossil Creek, just downstream of Thomas Road. Replacement housing is readily available in the general vicinity. Total estimated cost for acquisition and relocation assistance is approximately $445,000.

The proposed mitigation area for the Little Fossil Creek flood damage reduction project is located at the southern terminus of the project area, between the east bank of Little Fossil Creek and the Trinity Waste Landfill, south of the Railtran Railroad. The mitigation area is comprised of 11.04 acres of forested habitat, 19.89 acres of open water, and 33.11 acres of scrub shrub/old field habitat. The water body is an old gravel quarry with little or no aquatic habitat present. Preliminary coordination with the Fish and Wildlife Service has indicated that a possible mitigation plan for this area could include converting all old field/scrub shrub habitat to a bottomland hardwood riparian forest community by planting such species as pecan, bur oak, red oak, red mulberry, coral berry, Indian cherry, etc in the appropriate densities (80 trees and 30 – 40 shrubs per acre). An additional restoration feature of the mitigation area would be to use clean excavated overburden from the project to create 10 acres of shallow water wetland habitat. Populations of native aquatic plants would then be established in the shallow water through deliberate planting. Further definition of the mitigation plan for aquatic habitat would occur during the development of project Plans and Specifications.

Losses of stream aquatic habitat will be mitigated primarily through restoration of pool/riffle complexes. The upper reach between Belknap and Midway will be restored to the existing

condition of one meander wavelength that consists of 3 riffles, each occurring at the inflection points, and 2 pooled areas. The reach between Midway and the upstream end of the concrete channel, approximately 3,000 feet in length, will be designed to restore 6 meanders that will include 12 riffles and 12 pools. Finally, the southernmost reach from Carson to the downstream limit of the project will contain 1 meander including 3 riffles and 3 pools. The geometry of a naturally meandering stream varies with each channel cross-section, based on width, depth and slope. Other instream techniques will also be applied, where feasible, which include boulder clusters, rock check dams, and natural channel constrictors and deflectors. In addition, starting 1 year after completion of construction of aquatic mitigation features, the project area will be studied if impacted functions of the aquatic ecosystem are returning. Using Construction funds that have been included in the project cost estimate, the Corps will use the methodology endorsed by the U.S. Fish and Wildlife Service to indicate the degree that biotic integrity has been restored. If functions have not been restored after 3 years, then other mitigation actions will be conducted.

The Recommended Plan also represents the Federal NED Plan. The estimated total project first cost of this plan would be $ 11.1 million. The project cost and expected annual net benefits, annualized over a 50-year period at 6.375 percent interest rate, are estimated at $800,000 and $1.6 million respectively. The resultant project benefit-to-cost ratio would be 3.0. The Recommended Plan would alleviate approximately 82% percent of the expected annual flood damages estimated to occur within the Little Fossil Creek study area between the Belknap Street and State Highway 121.

The flood control plan as proposed will provide a very high degree of protection to residences along Little Fossil Creek from floodwaters emanating from the creek. Also, local drainage problems observed by a number of residents should be improved as the Recommended Plan increases the flow capacity of the Little Fossil Creek.

The City of Haltom City has been presented with the findings of this study and the cost sharing requirements of the Recommended Plan. The city has indicated that its existing financial resources would not likely be sufficient to meet the non-federal requirements of the Recommended Plan. Consequently, the city is investigating the possibilities of issue a municipal bond to raise additional funds for the Recommended Plan. The city of Haltom City has the authority and financial capability to provide the required non-Federal cooperation. Funds to operate and maintain the project following construction would be provided through the city's annual operation budget.

RECOMMENDATIONS

I recommend that the plan described in this report as the Recommended Plan be authorized for implementation under the authority of Section 205 of the 1948 Flood Control Act, as amended, as a Federal project, with such modifications as in the discretion of the Chief of Engineers may be advisable; at a first cost presently estimated to be $11.1 million.

Robert P. Morris, Jr.
Lieutenant Colonel, Corps of Engineers
Acting District Engineer

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch.

FINDING OF NO SIGNIFICANT IMPACT

Local Flood Protection Project (Section 205)
LITTLE FOSSIL CREEK, HALTOM CITY, TEXAS

Little Fossil Creek is a perennial stream located in central Tarrant County, in north central Texas. Little Fossil Creek originates near the northern city limits of Saginaw and flows southeasterly through Saginaw, Blue Mound, Fort Worth, and Haltom City before converging with Big Fossil Creek just north of the Trinity River. The creek has a total drainage area of 18.6 square miles. At the request of Haltom City, the U.S. Army Corps of Engineers initiated studies under the authority of Section 205 of the Flood Control Act of 1948, as amended, to evaluate potential solutions to flooding problems associated with Little Fossil Creek within the city limits of Haltom City.

Structural and nonstructural alternatives that were evaluated for consideration included flood regulation, flood forecasting and warning, flood proofing, flood plain management, permanent relocation, detention ponds, levees, hydraulic channels, and bridge relocations. The hydraulic channel was the only alternative that proved economically, technically, and socially feasible. Hydraulic channels with bottom widths of 45, 60, 75, and 90 feet were evaluated for further consideration. A 75-foot bottom width hydraulic channel alternative approximately 7,500 feet long was selected as The Recommended Plan.

The Recommended Plan consists primarily of a 75-foot average bottom width, combination grass- and concrete-lined trapezoidal channel with one-sided, alternating bank side slope cuts where possible. The plan would begin approximately 1,100 feet downstream of the Railtran Bridge and proceed upstream to a point just downstream of the Belknap Bridge. The total project has an aggregate length of 7,350 feet, which includes channel widening and deepening, including erosion control features where necessary. In order to provide the needed channel capacity to pass the 100-year storm event through the Carson Street/S.H. 121 Bridge group, while sustaining velocities up to 15 feet per second with minimal friction losses, a 45-foot bottom width concrete-lined, trapezoidal channel with 1.5:1 side slopes would be constructed. This channel configuration is the largest allowable without replacing the bridge structures, while still preventing the split flow to the east. The Recommended Plan also calls for a partial gabion lining to be used in the section just upstream of the Midway Road Bridge.

Implementation of the Recommended Plan would cause the displacement of seven residences and one horse barn. All of these residences are located along Orval Court on the west side of Little Fossil Creek, just downstream of Thomas Road. Replacement housing is readily available in the general vicinity. Total estimated cost for acquisition and relocation assistance is approximately $445,000.

The Recommended Plan also proposes a multi-purpose trail designed to provide access for hiking, jogging, bicycling and nature study. The plan consists of approximately 6,250 linear feet of ten-foot wide concrete multi-use trail along the west side of Little Fossil Creek, connected by a low-water crossing to an additional 6,000 linear feet of 6- to 8-foot wide unsurfaced nature trail, circling a small lake in the mitigation area. The trail system would be accessible from adjacent neighborhoods. More remote residents would be able to drive and park their vehicles at one of four access areas located on Orval Court, Belknap Street, Garden Street, and a site adjacent to the terrestrial mitigation area.

The Recommended Plan, as proposed, would provide protection for 540, or an estimated 87% of the structures along Little Fossil Creek, from a 1-Percent Annual Chance Exceedance Flood (approximately a 100-year flood).

The flood damage reduction features of the Recommended Plan were evaluated for impacts to cultural resources and the natural and human environment. The Recommended Plan includes environmental mitigation that would fully offset adverse impacts to the terrestrial and aquatic ecosystem of Little Fossil Creek. It was estimated that the Recommended Plan would adversely impact 1.9 acres of old field and 17.9 acres of forested area. All aquatic habitat within the reaches of the creek that are proposed for construction would be modified as a result of the proposed project. Based upon agency comments during plan formulation and during the public comment period, plans to fully mitigate terrestrial and aquatic impacts were finalized. The terrestrial mitigation plan would be implemented in an area adjacent to the study site and would involve the acquisition and management of 65 acres of mitigation lands, consisting of 11.0 acres of existing low quality forested habitat and 54 acres of grassland or old field that would be intensively managed to convert into bottomland hardwood forest. These terrestrial mitigation features would provide average annual habitat values of 12.45 units determined necessary to fully compensate for terrestrial habitat losses.

Losses of stream aquatic habitat would be mitigated primarily through restoration of pool and riffle complexes within the area modified by construction of the flood damage reduction feature of the project. The upper reach between Belknap and Midway would be restored to the existing condition of 1 meander wavelength that consists of 3 riffles, each occurring at the inflection points, and 2 pooled areas. The reach between Midway and the upstream end of the concrete channel, approximately 3,000 feet in length, would be designed to restore 6 meanders that would include 12 riffles and 12 pools. The southernmost reach from Carson to the downstream limit of the project would contain 1 meander including 3 riffles and 3 pools. Other instream techniques would also be applied, including boulder clusters, rock check dams, and natural channel constrictors and deflectors. In addition, starting 1 year after completion of construction of aquatic mitigation features, the project area would be monitored to evaluate success of the instream structures in mitigating impacted aquatic ecosystem functions. Monitoring would include use of a biotic integrity index methodology in coordination with the U.S. Fish and Wildlife Service. Adaptive management would be applied in response to the observed aquatic habitat recovery; and should biotic functions not be fully restored after 3 years, additional mitigation actions would be conducted as necessary to restore aquatic habitat function. Additional aquatic mitigation would be conducted on 10 acres of vegetated shallow water habitat within the 19.9-acre open water area, an abandoned quarry, by resloping the edges of the waterbody and planting rooted aquatic plants.

The Texas State Historic Preservation Officer has concurred with our assessment that no significant archeological sites or historic properties would be affected. The possible consequences of the recommended plan have been considered in accordance with Sections 404 and 401 of the Clean Water Act. Texas Commission on Environmental Quality, formerly known as the Texas Natural Resource Conservation Commission, has reviewed the project proposal and has indicated that the recommended Plan with incorporated terrestrial and aquatic mitigation is in compliance with Section 401 of the Clean Water Act. The recommended plan is in compliance with the Endangered Species Act and the Executive Order 11988, Floodplain Management.

Based upon the Environmental Assessment and results of coordination, I have concluded that the proposed action would not have a significant adverse effect on the human or natural environment. Consequently, construction of the proposed project would not constitute a major Federal action of sufficient magnitude to warrant the preparation of an Environmental Impact Statement.

22 JAN 2003
Date

Robert P. Morris, Jr.
Lieutenant Colonel, Corps of Engineers
Acting District Engineer